PERSONNEL SYSTEM PROJECTION MODEL

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THESIS

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by

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December 1972

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN COMPUTER SCIENCE

from the

NAVAL POSTGRADUATE SCHOOL
December 1972

ABSTRACT

A personnel system is simulated so that the personnel planner can use this simulation as a tool to help solve manpower problems utilizing the benefits of a computer. The input parameters are time in grade and time in the system of each individual, the manpower requirements in each grade, annual input to the system, and the number of years to run the simulation. The dynamic properties of the simulation are loss rates and promotion rates. A decision maker runs the model to determine the effects of changes in the input parameters. One of the problems that can be solved with the model is manpower shortage. A sample problem is presented. Flowcharts and a listing of the Fortran program are included.

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I. INTRODUCTION

Personnel systems composed of a formal rank or grade structure that utilize a promotion procedure to move persons through or out of the system are commonplace in modern large organizations. A classical example is the corps of the military services of any country. Because of the universality of such systems, the problems of maintaining stability within the systems may also be common to them. Accordingly, I am going to focus my study on a navy personnel system, that could be found in any small or mid-size military organization.

The purpose of the study of such a system is to develop a model to simulate the system so that the personnel planner can use this simulation as a tool.

Traditionally, it was relatively easy in the navy to forecast and preserve the stability of the system because of sufficient manpower. The personnel planner could operate with "rules of thumb" with no difficulty. But now maintaining the system is more difficult because of problems in recruiting and the longer time spent in training personnel as a result of the greater complexity of the weapons. There are also the constraints of manpower resources and the budget and several other new problem areas. As a result effective management of personnel resources has become an increasingly critical element of a navy's ability to meet its operational commitments and achieve its long-range objectives.

Personnel management is associated with many programs, plans, and policies whose purpose is to initiate and control the flow of personnel through the system to insure sufficient personnel resources in the various occupational specialties or ratings for each grade at specific

points in time. There are four fundamental but interrelated tasks involved in personnel planning:

1. Maintain personnel inventories to accomplish a spectrum of naval missions.
2. Project current inventories forward in order to determine the feasibility of meeting future needs.
3. Compare future requirements and predicted resources to determine areas of potential shortage or surplus. This is necessary to prevent or correct imbalances or deficiencies before they become critical; that is, before corrective action is either impossible or very costly.
4. Analyze the projected effects of present and proposed personnel policies in order to evaluate the possible outcomes. To do this, it may be desirable to test the feasibility of changes by programming those changes in a model which simulates the behavior of the personnel system.

A conventional personnel cycle (as described in Ref. 1) functions as shown in Figure 1. A planning data base provides input to the projection module in the form of starting inventories and rates of change. The projection model acts on these inventories by calculating the major input output flow in the personnel system and producing a projection of the force, by size and composition, at specified times in the future. This output then becomes input for programs which produce plans for career development, enlisted advancement, strength management, training input, and personnel policy evaluation. The execution of such plans triggers retirement, promotion, separation, and training actions throughout the system. These actions are consequently recorded by the personnel accounting system and become new input for the data base.

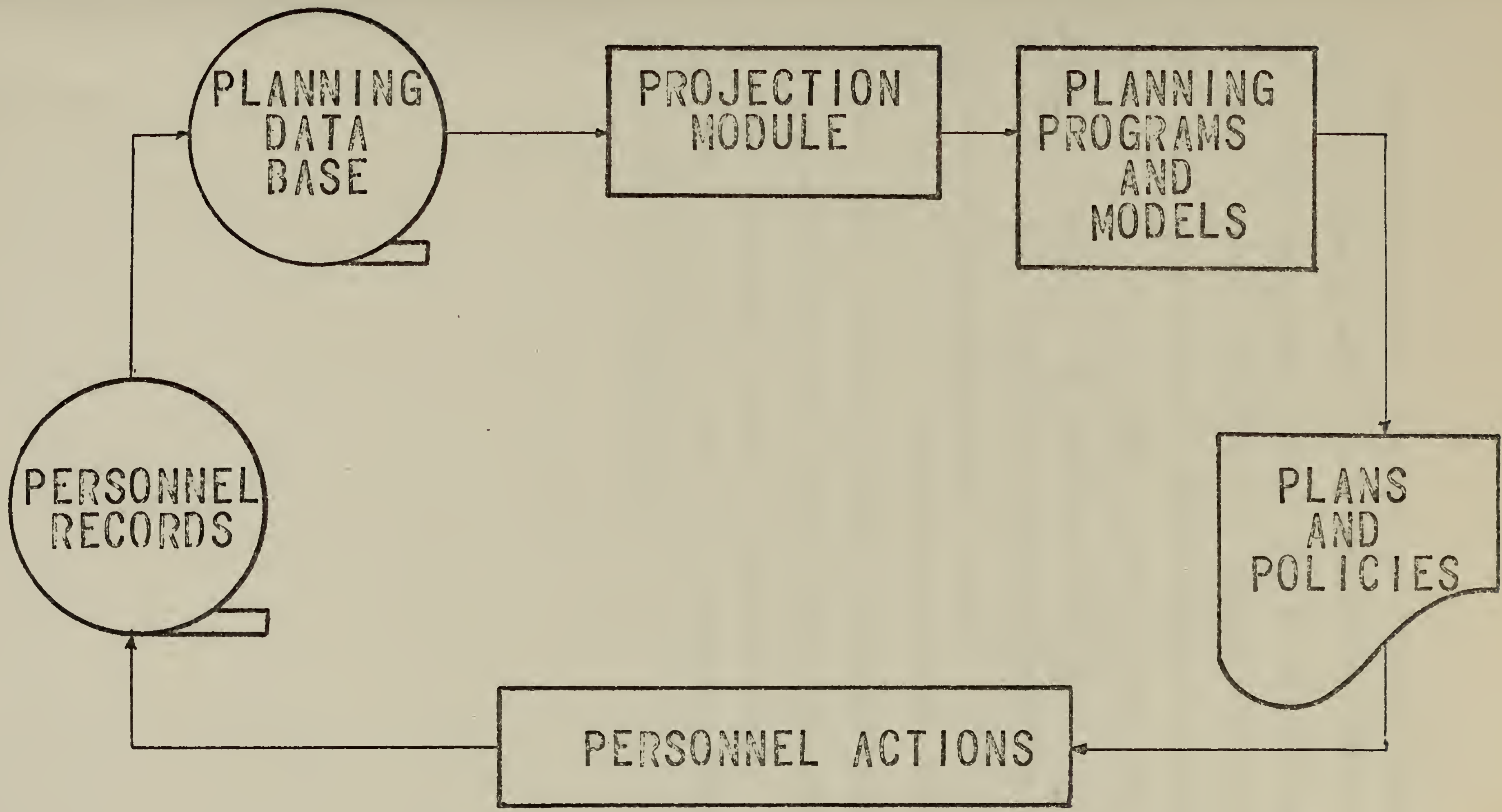


FIGURE 1. PERSONNEL PLANNING CYCLE

The specific purpose of this paper is to develop, analyze, and simulate a projection model of such a navy officer system. The goal that is sought is to create a tool to help the personnel manager solve the types of problems enumerated above using the benefits of a computer. Since the personnel planner is a manager and has to worry about the substance of the problem in order to solve it in any optimal way, to divert his attention to the techniques of solving it is obviously detrimental. Thus, the idea is to develop a computerized simulation to give to the manager the technique to solve the problem without taking his attention away from the substance of the problem. This projection model will permit the personnel planner to accommodate rapidly to modifications in requirements and to detect problem areas, such as shortage or surplus of personnel at a point in time and in grade. The projection model will also provide the tool to test alternative manpower plans and policies prior to the implementation.

II. MODEL FORMULATION

To build the model, I am going to take as an example the officer corps of a navy organization.

A. GRADE STRUCTURE

The input to this system is through the naval academy only. There are five years of study before entering the officer system. The losses in this part are not going to be considered, so the number of cadets entering the academy are going to enter the officer system after five years.

The first contract to serve is made for 7 years starting the day of entering the officer system. Then there is no further contract so separation by resignation is possible.

The system is composed of eight grades. They are: ensign(P1), lieutenant junior grade (P2), lieutenant (P3), lieutenant commander (P4), commander (P5), captain (P6), rear admiral (P7), and vice admiral (P8).

There are two consideration in each grade: the minimum time in the grade to be eligible for promotion and the maximum permissible time in each grade. These considerations are different for each grade and are in Table I.

For ensign, three years is the minimum requirement and four the maximum. This means that an ensign will be eligible for promotion only one time before being forced to leave the system if he is not promoted. Similar restrictions apply to the other grades.

For Vice Admiral there is no minimum time for promotion because it is the highest grade in the system, and the maximum does not exist in terms of time in grade. The maximum time in the system is 35 years.

TABLE I

MINIMUM AND MAXIMUM TIMES IN GRADE FOR EACH GRADE

CODE	GRADE	MINIMUM REQUIRED TIME IN GRADE	MAXIMUM PERMISSIBLE TIME IN GRADE
P1	ENSIGN	3	4
P2	LIEUTENANT J.G.	3	6
P3	LIEUTENANT	4	10
P4	LT. COMMANDER	4	8
P5	COMMANDER	4	8
P6	CAPTAIN	4	8
P7	REAR ADMIRAL	4	8
P8	VICE ADMIRAL		maximum time in the system

B. LOSSES

The losses in each grade because of different reasons such as death, retirement, or resignations are lumped together. The percent losses in each grade, with the exception of lieutenant, are shown in Table II. For lieutenants, the analysis is made more in depth because it is considered the more critical grade in the system for several reasons. First, this is the grade where losses are greater than in any other because in this grade the contract to serve expires. Second, the promotion flow beings to slow for reasons inherent in this type of system. Therefore, the officers with 5, 6, 7, 8 and 9 years in the grade have different loss rates as shown in Table III. Those with 5 years have a loss rate of 30% because they have already one passover for promotion. The large loss rate at 8 and 9 years is due to the fact that these officers begin to realize that they will, in all likelihood, be forced out at 10 years and, accordingly, begin searching for other careers. With 10 years, everybody goes out because that is the maximum time in the grade.

C. PROMOTION POLICIES

Once a year there are promotions, and the mechanics for this are the following:

First, there is a check as to what vice admirals are going to retire because of time in the service. Then the requirements for this grade are compared against the actual population and the vacancies are determined. The population of rear admirals ready is then analyzed and a list is formed with all the rear admirals ready to be promoted. Then rear admirals from this list are promoted to fill the vice admiral requirements. Sometimes this is not achieved because the list is smaller

TABLE II

ANNUAL LOSS RATES FOR ALL GRADES EXCEPT LIEUTENANTS*

CODE	GRADE	PERCENT LOSSES PER YEAR
P1	ENSIGN	0
P2	LIEUTENANT J. G.	2
P4	LT. COMMANDERS	2
P5	COMMANDERS	2
P6	CAPTAINS	2
P7	REAR ADMIRALS	2
P8	VICE ADMIRALS	1

* Excludes losses due to excess time in grade.

TABLE III

ANNUAL LOSS RATE FOR LIEUTENANTS BY TIME IN GRADE*

TIME IN GRADE(P3)	% LOSS RATE
5	30
6	20
7	10
8	80
9	80

*Excludes losses due to excess time in grade.

than the number of vacancies. Moreover, for the rear admirals there are only three opportunities to be promoted. This means that a particular rear admiral can only repeat 3 times in the list above mentioned.

After the number of rear admirals to be promoted is calculated, the vacancies for rear admiral are determined based on requirements and the population of rear admirals, less those to be promoted. A similar analysis is made to determine the priority of captains to be promoted to rear admiral. In the case of the commanders, lieutenant commander, lieutenant and lieutenant junior grade the analysis for calculating the vacancies is similar, and the procedures to determine the ones to be promoted is also similar.

In the case of cadets to be promoted to ensigns, the procedures are different because all the cadets in the fifth grade are going to be promoted to ensign after passing their final examinations regardless of what the vacancies are for ensign. In other words, the vacancies for ensign are not taken into account to promote the last year cadets. The promotions from one cadet year to the next are only based on exams and not on requirements. Only the input to the academy is based on requirements. An example of the advancement methodology used in this system is shown in Table IV.

D. INPUT PARAMETERS

The input parameters to the model of the system are the number of cadets entering to the system, the requirement in each grade, the number of people in each grade at any specific time, and the number of years the model is to run.

The model must keep track of the time in grade and total time in the service for each element of the system.

TABLE IV

ADVANCEMENT METHODOLOGY

CODE	NET STRENGTH* (a)	REQUIREMENTS (b)	VACANCIES (c)	ELIGIBLE TO PROMOTION (d)	ADVANCE (e)
P8	3	5	2	-	-
P7	14	20	6	7	2
P6	28	40	12	12	6
P5	65	80	15	9	9
P4	98	120	22	35	15
P3	121	180	59	42	22
P2	132	180	48	35	35
P1	145	180	35**	38	38

*Net strength after promotions in column e have been made.

**Filled by graduates from the Naval Academy.

III. THE IMPLEMENTATION

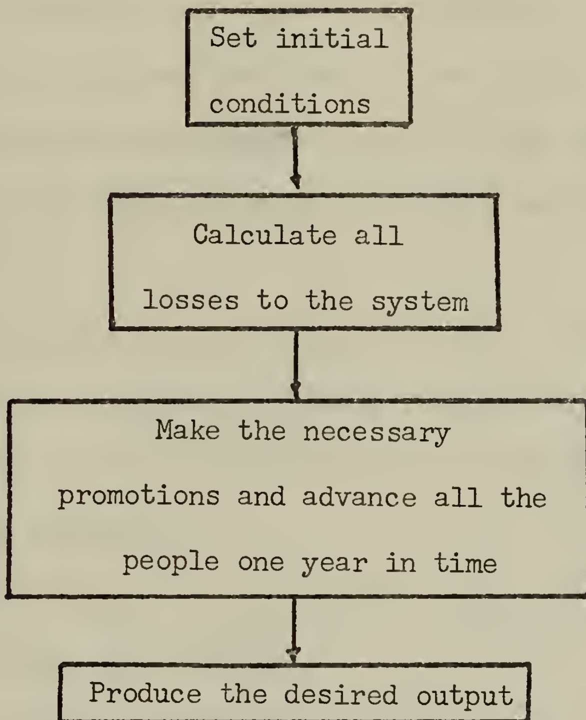
A. OVERVIEW OF THE IMPLEMENTATION

The primary motivation for the implementation was that the program had to produce an output that a personnel planner could use to solve problems. This meant that the implementation had to be simple enough for the personnel planner to know what the program was doing without much computer or programming knowledge. It also had to be very versatile in order to be applicable to many personnel systems similar to the one described and versatile in adapting to policy changes in the distributions of losses and promotions. Another characteristic required of the program was that the output had to be in a form that provided just enough information to the personnel planner in a very easy form to read. Excessive amounts of information would be considered undesirable. These were the basic requirements of the implementation program.

In order to meet these requirements the approach was to build different programs for the basic functions. One program was devised to calculate all the losses to the system; another program, to promote and advance the people in time; and the third program, to produce the correct output. These three programs were to be driven by a monitor program to read the initial data of the system and run the model for the time desired. The program in charge of the losses to the system was called OUT, the one able to promote and advance in time was called AVANCE, and the one that produce the output was called OUTPUT. The whole program kept track of time in the system and time in grade at any moment for each member of the system being modeled.

This was done with a four digit number for each member. The first two digits were the time in the actual grade and the last two, the total time in the system.

In summary, the basic approach was as follows:



A listing of the Fortran program is available in Appendix C.

B. THE OUT PROGRAM (FIGURE 2)

This program calculates all the losses to the system and applies these losses to the data base. The different reasons to go out of the system are more than 35 years in the system, number of years in grade, death, resignation, medical reasons and others. In this program the first two reasons are considered as two separate items. The other reasons will be combined as one.

The purpose in doing this is to keep a probabilistic orientation to the program. The distribution of losses is presently arbitrary, but

when the program is used in the real system, it would be possible to calculate the distributions based upon past data. The flowchart of the program is given in Figure 2.

C. THE AVANCE PROGRAM (FIGURE 3)

This program designates individuals for promotion, promotes the necessary number, and advances one year in time all the people in the system. The way this is implemented is clear in the general flowchart, but to complement that description the following additional details are given.

First the vice-admirals are advanced one year. Then rear-admirals with 4, 5 and 6 years in grade are placed in three vectors (VEC1, VEC2, VEC3), respectively. The rear-admirals to be promoted come from these three vectors (See Appendix A).

This is done by forming a vector (ROL1) using a routine called PROL and another subroutine called ROLNO.

The subroutine ROLNO takes people from the three vectors and builds a list (ROL1) designating the order for promotion.

The subroutines PROL, SROL, TROL, CROL, QROL, SROL and SEROL designate the particular order to pick persons from the three vectors by ROLNO, according to the particular grade in the system.

After all rear-admirals qualified for promotion have been ordered (ROL1), the number to be promoted is determined by taking the smaller between those qualified for promotion and the necessary number to cover requirements for vice admirals.

The same procedure is used for the other grades, but the subroutine PROL is replaced by SROL in captains, TROL in commanders, CROL in lieutenant commanders, QROL in lieutenants, SROL in lieutenant junior grade,

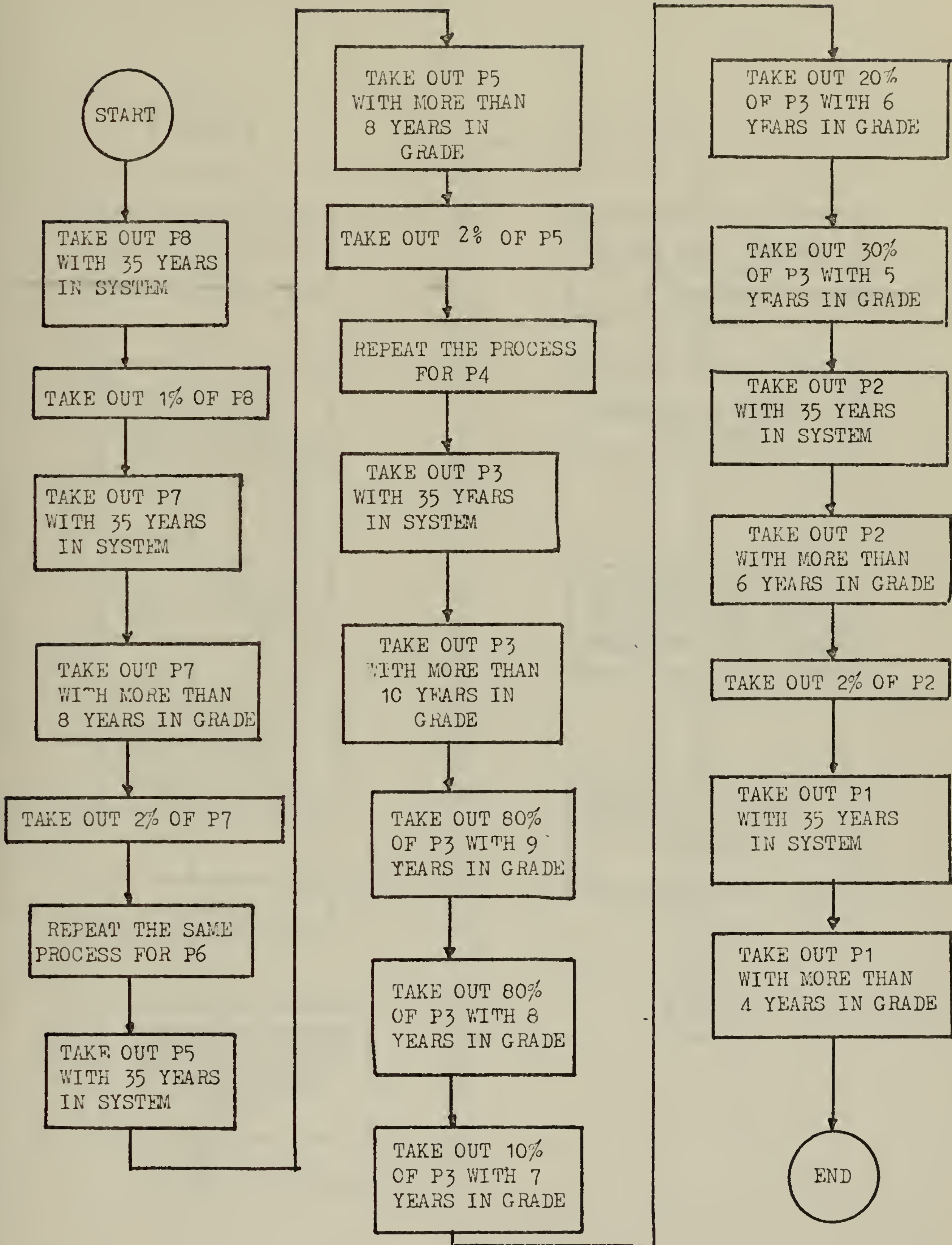


FIGURE 2. SUBROUTINE OUT

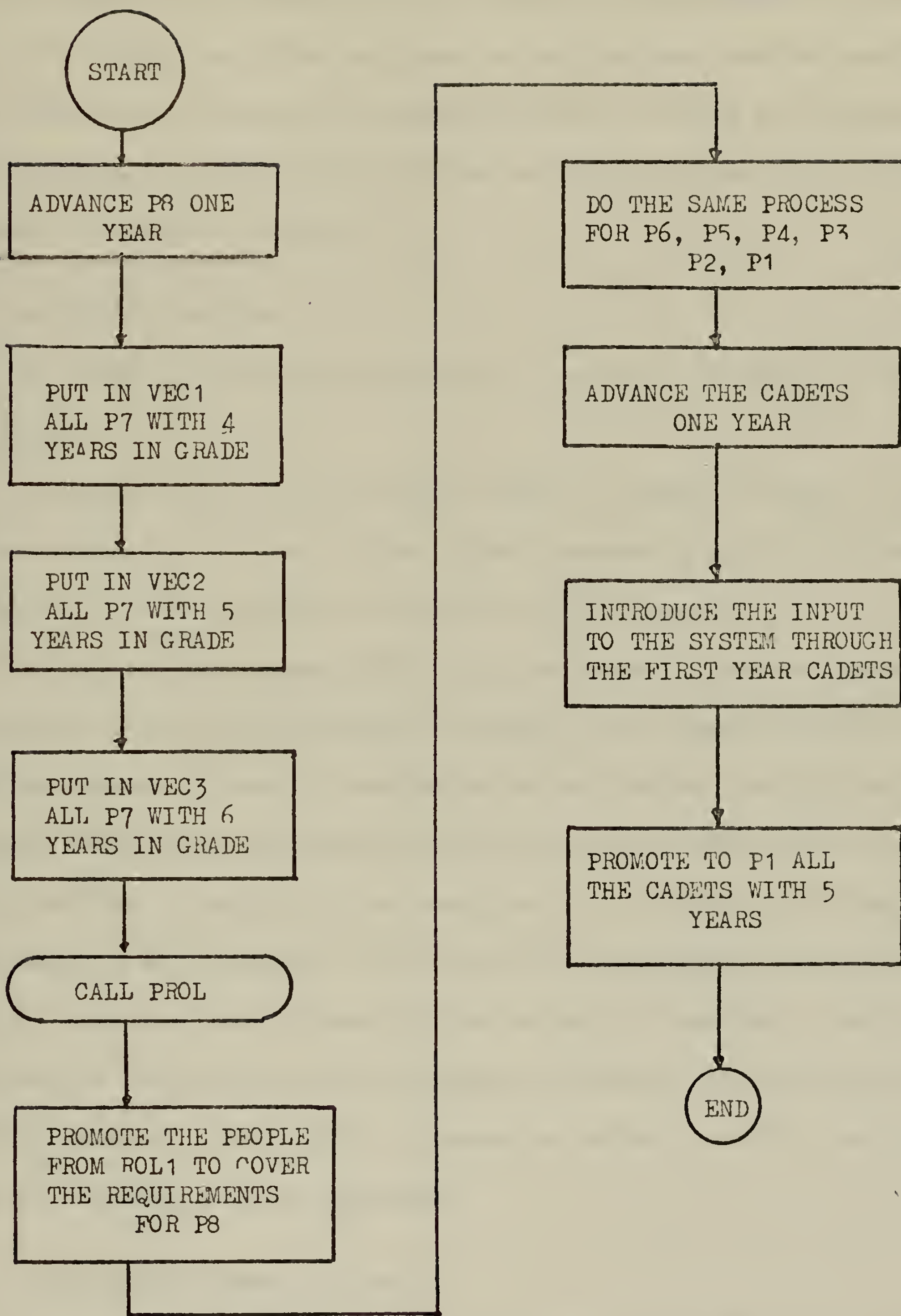


FIGURE 3. SUBROUTINE AVANCE

and SEROL in ensigns. Each of the subroutines call the subroutine ROLNO to form the promotion list (ROL1) for each grade (See Appendix B).

The input to the system is also driven by this program. At each cycle the cadets go to the next year of the academy, and the cadets in the fifth year are promoted to ensign without checking the vacancies for ensigns. In other words, all the cadets in the last year of the academy always go to ensign.

D. THE OUTPUT PROGRAM

The OUTPUT program is implemented to produce four different forms of output.

To produce any of the particular forms of output one must call it with a number 1, 3, 4 or 5. The outputs produced are first (number 1) a list of all the people in the system at that moment.

Calling the subroutine OUTPUT with the number 3 provides graphs of each grade which plot the number of people in the grade on the Y axis and the number of years of simulation on the X axis. Calling the subroutine OUTPUT with the number 4 will result in a table with the number of promotions in each grade and each year of simulation. Calling with the number 5 will produce a listing of the requirements for each grade and the number of people entering the academy in that year. Before calling the subroutine with the number 3, however, it has to be called with the number 2 each cycle of the run in order to provide the information necessary for the plotting.

E. THE MONITOR PROGRAM (FIGURE 4)

The monitor program has to perform several fixed and some optional functions. The fixed functions are: read the initial data of the system,

the requirements in each grade, the number of people entering the system, and the number of cycles of the simulation.

The optional functions change the requirements during a simulation run and change the input to the system during the same run. The way this program handles the three major subroutines OUT, AVANCE, and OUTPUT is very much up to the designer of the simulation experiment. An example could be to run the model for 20 years and each year call subroutine OUT, then AVANCE, and after the 20 cycles, call OUTPUT. Another example could be to run for 20 years, call OUT and AVANCE each cycle, but in the fifth cycle change the requirements and after the twentieth cycle, call OUTPUT. These examples illustrate the versatility of the program and the requirements placed on the art of the designer of the experiment to be able to perform what he is asked to.

F. VERIFICATION AND VALIDATION

The verification of the simulation model was done in the following manner. The model was run for 20 years and each time it completed each subroutine, an output listing the contents of the data base was called that is, the contents of all the arrays. With this output, it was possible to check the working of each subroutine. After this check, changes were made to the input and the subsequent output was checked with the logic of the function. That is, for example, there has to be an increase in the number of people in the first grade only.

In experiments with a real system, the validation of the model would be a straightforward empirical matter, but actual losses and advancements would be used instead of the present case with an arbitrary personnel system [Ref. 2].

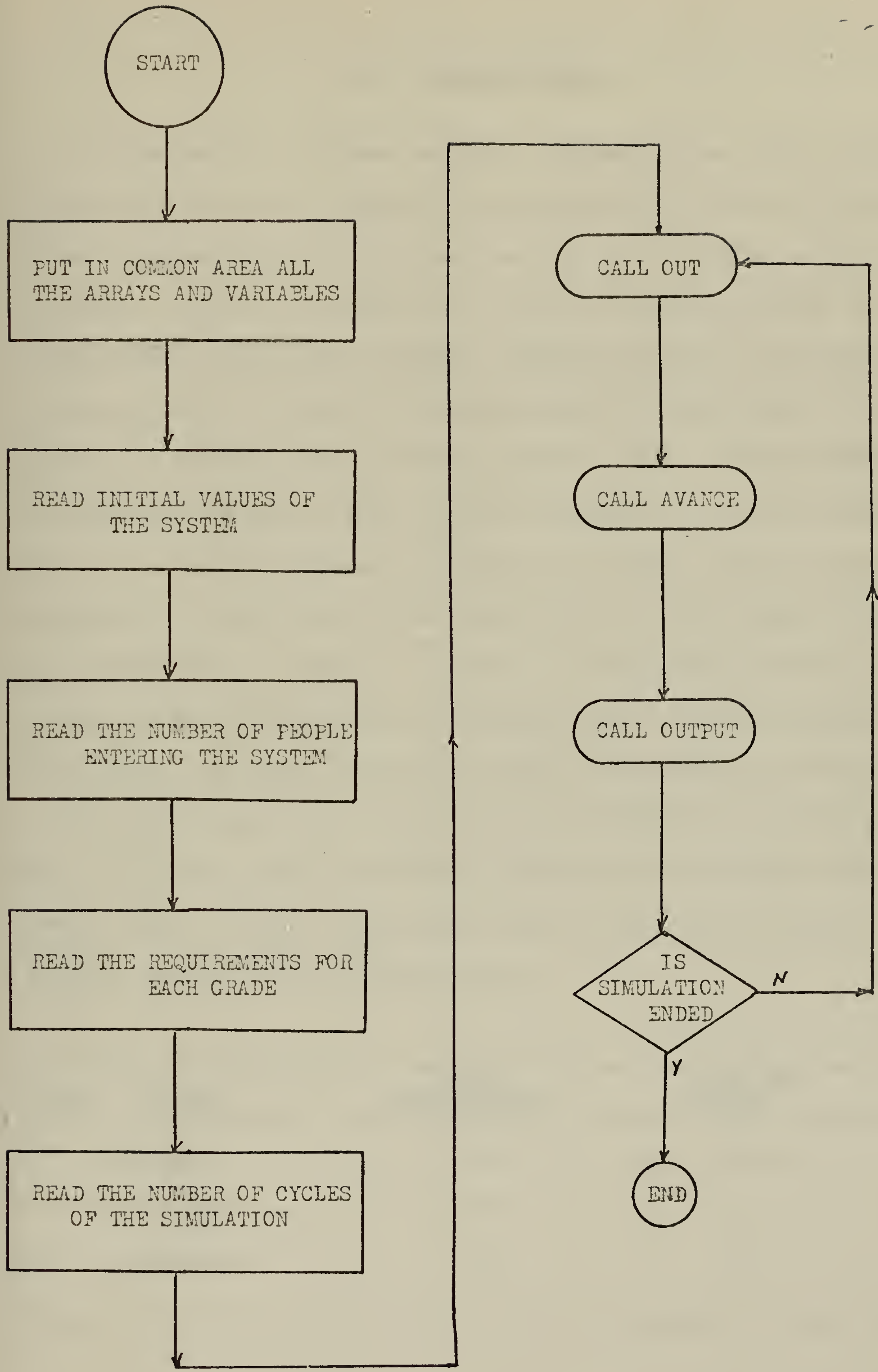


FIGURE 4. MONITOR PROGRAM

IV. SAMPLE PROBLEM

In this section, a simple personnel problem will be posed, and the program will be used to examine the consequences of possible solutions. First, in order to have the system ready for experimenting, we had to observe it and put in a sequence of values for persons entering the system (INGO) so that the system was stabilized. That is, the flow of personnel had to be smooth and continuous and the requirements for each grades were being met over a 30-year period of time. It was assumed, as previously explained, that the time permissible in grade is invariable. This could be because the minimum and maximum times in grade are determined by regulations or laws, and it is not in the power of only one organization to change it. Further, it was assumed that the input to the system is through the Naval Academy only, it is not possible to skip grades, and losses for various causes are as stated in Section II.

The problem posed was a change in requirements for some grades. That is, in five years from now the requirements for the first three grades, namely ensigns, lieutenants junior grade, and lieutenants are going to change in the following manner:

CODE	GRADE	ACTUAL REQUIREMENTS	WITH THE CHANGE
P1	Ensigns	120	160
P2	Lieutenants J. G.	120	160
P3	Lieutenants	130	180

This change could be the result of a ship acquisition. The delivery is going to be in 5 years, and we want to be sure that in that time we are going to have the necessary people to run the ship in an efficient way. This means that we have to have the necessary number and in the appropriate grades, resulting in the change of requirements shown.

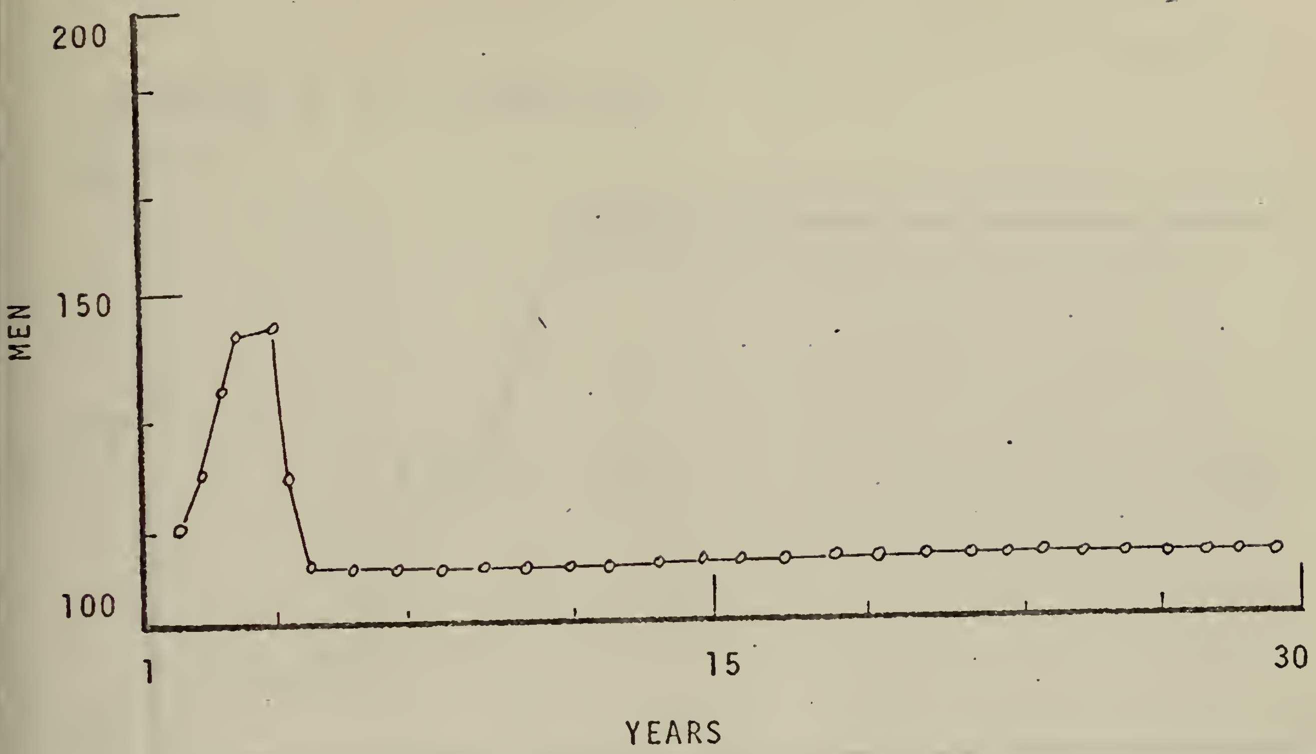
Since each year there is a loss of manpower from people that reach the maximum permissible time in a grade and are not promoted, when a change of requirements comes it could be the case that all of these persons could be promoted and cover all the vacancies in the next higher rank created by the change of requirements. The first possible solution is to investigate if this is the case.

In order to test this alternative we run the model for 30 years changing only the requirements in the year 5 but keeping the input fixed. That is, the input to the system through the Naval Academy will be the same before and after the change of requirements.

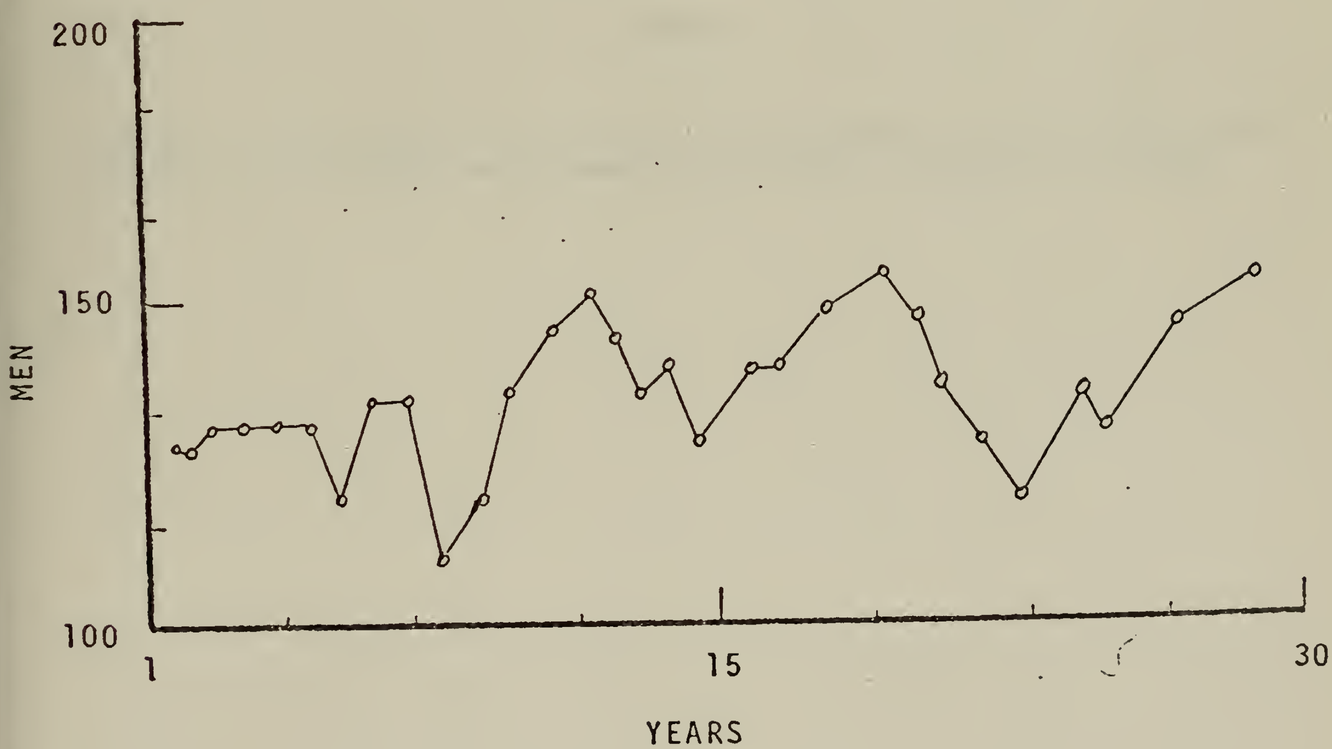
Figures 5a, 5b and 5c show the behavior of grades P1, P2 and P3 to this alternative. The other grades are not shown here because they are stable, their requirements are being met, and there have not been any changes in their requirements.

From Figure 5c we can see that in rank P3 in the fifth year, when the change of requirements was implemented and we promoted all the P2 eligible for promotion, there was not a sufficient increase to meet the new requirements. The P3 force went only to 150 men. This means that in that year, if no change of requirements were made, there were 30 P2 in the promotion list who would not have been promoted to P3. Some of these would have been forced to go out of the system because they reached the maximum permissible time in the grade, and some would have another

a. BEHAVIOR OF P1 (ensigns).



b. BEHAVIOR OF P2 (lieutenants J.G.).



c. BEHAVIOR OF P3 (lieutenants).

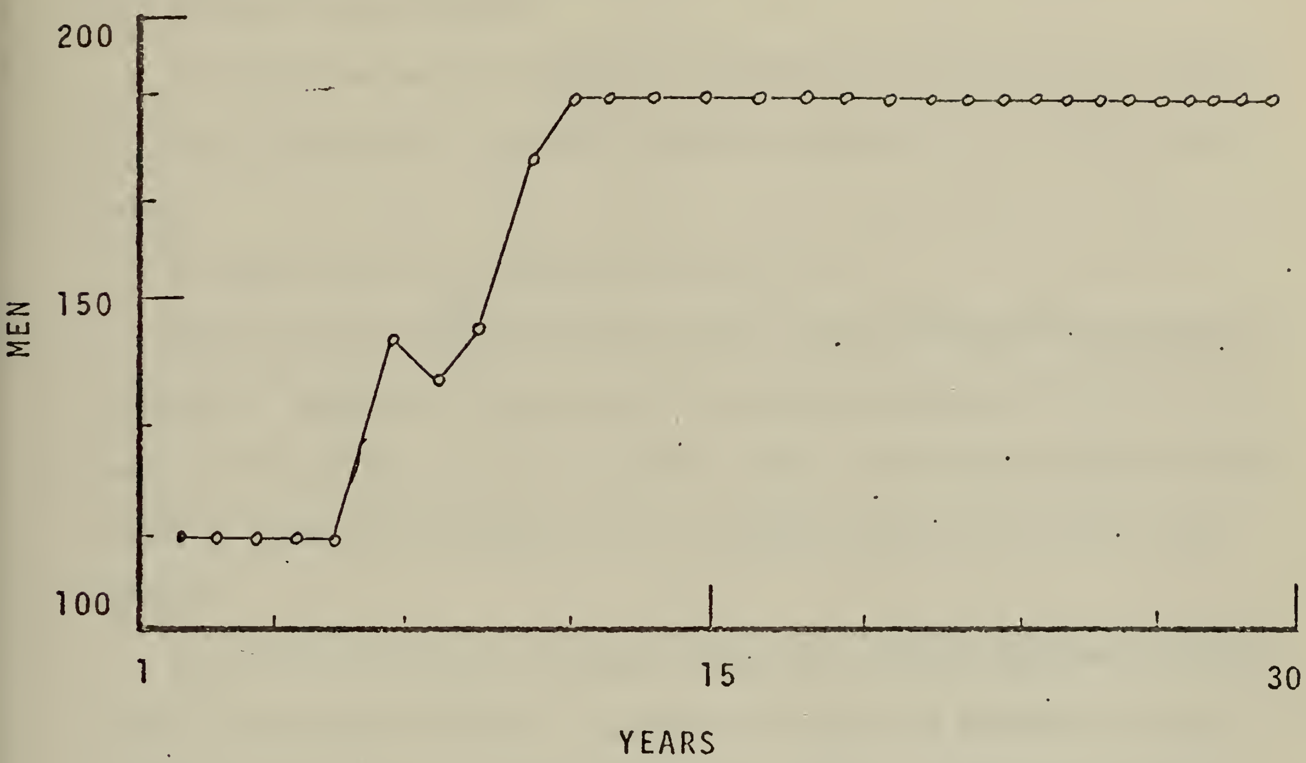


FIGURE 5. Response of the personnel system in the first three grades to changing requirements without a change in input.

opportunity to be promoted next year. The shortages continue for the next 2 years, and the requirements are not met until the 5th year after the change of requirements.

In P2 the response is completely different as one can see in Figure 5b. The requirements are never met and every year P2 is short of manpower.

A similar case is P1 shown in Figure 5a.

What we have accomplished with this exercise is that we know that a problem of shortages in the three first grades is going to exist for 3 years in P3 and forever in P2 and P1. This is the first purpose of the model to locate the problem area. The next step is how to solve the problem.

Since we do not have a mathematical model for this system we cannot find a mathematical formula or process to give us a solution. Thus, a solution can be reached by two approaches. One is using the model to help us find a sequence of inputs so that the grades in question can meet their requirements in the shortest possible time and after that be stable. This can be accomplished by testing several sequences of inputs and analyze their outputs in a very informal and qualitative manner.

The other approach is to use the computer simulation only to test some solution that was reached by some other method such as experience, mathematical modeling [Ref. 3 & 4] or any other source. In this case the computer simulation is used to see what the behavior of the system is with respect to such solutions. For example, we could have a mathematical model of a part of the system that could be the source of a possible solution. By using only this mathematical model, we cannot be certain if that is the optimal one. That is why we want to test it in the computer model.

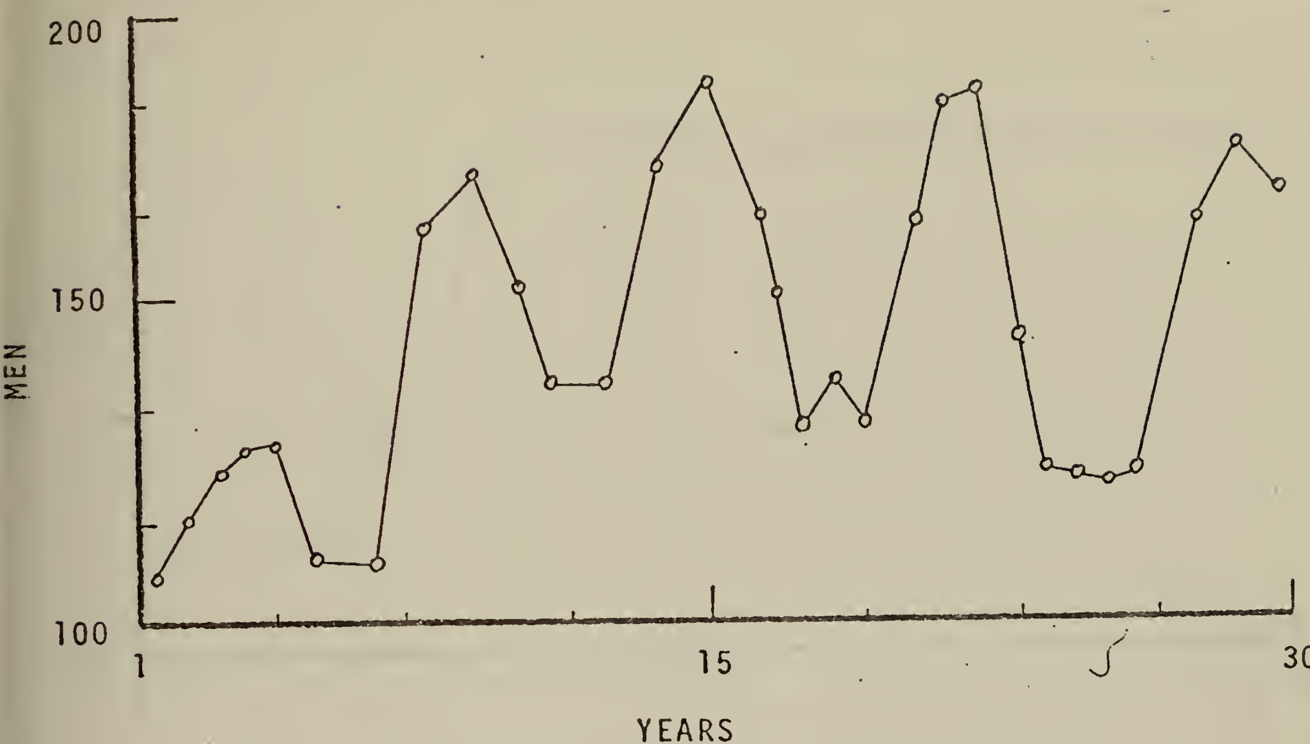
The approach we took in this paper is the first one; that is, to use the computer model to find and test the solution. That was done by testing different sequences and analyzing their outputs clinically to reach a solution. The solution was to use the following sequence of annual student input to the Naval Academy --54, 86, 41, 40, 60, 25, 54, 74, 40, 65,-- for the first 10 years, after which the annual input would stabilize at 47. The effects of this solution are shown in Figures 6a, 6b and 6c. The graphs of only P1, P2 and P3 are shown because they are the only ones affected by the change and are where the problem area was located. Nevertheless after reaching a solution we have to be sure that the other grades are not affected in a negative way, but in this case they kept stable.

As one can see in Figure 6c, P3 still has 3 years after the change of requirement where they are not met. This is because input to the system in year one cannot affect P3 until year 12 due to the fact that, at the very minimum, the input has to go through 5 years in the academy, 3 as ensign (P1) and 3 as lieutenant J.G. (P2) to reach P3.

As observed in Figure 5b, P2 was a critical grade because it never met its requirements. In Figure 6b one can see that the requirements are reached in 4 years after the change and is stable with some very small shortage in years 14, 15, 16, 22, 23 and 24.

In Figure 6a once can see that P1 has a stable wave with an average of 160 persons. In this grade, since the promotion from cadet to ensign (P1) is not based on vacancies as in all the other grades, the stabilization comes to be a cyclic curve, the same shape that we have in the stable system before any change in requirements occurred.

a. BEHAVIOR OF P1(ensigns).



b. BEHAVIOR OF P2 (lieutenants J.G.).

c .BEHAVIOR OF P3 (lieutenants).

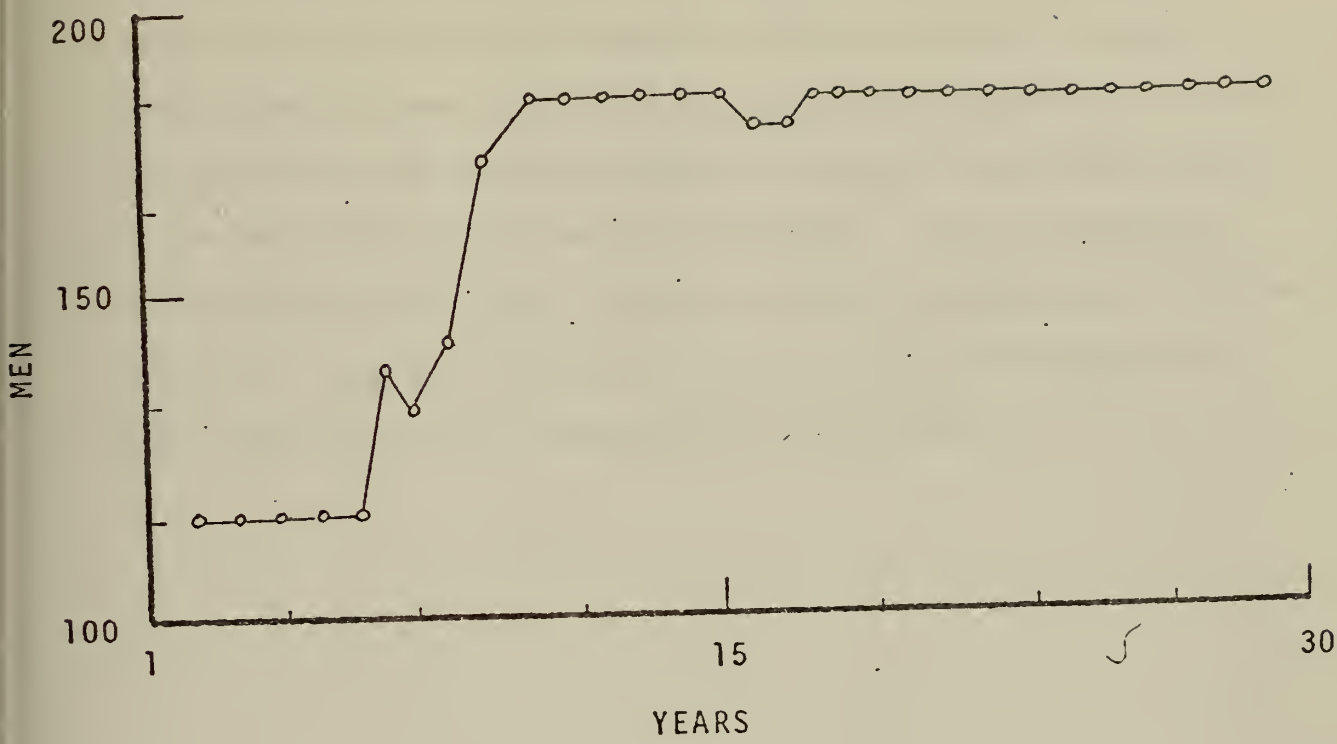


FIGURE 6. Response of the personnel system in the first three grades to changing requirements and introducing an input sequence.

This solution reached in this particular problem is not by any means the only one or the optimal one. Since the losses and time in grade parameters were arbitrarily determined, and no personnel overages are permitted in the program, perhaps no solution to the problem would be desirable without changing these parameters. But, as expressed in the beginning of this paper, the whole purpose of having such a computer simulation is to test different policies in a "what would happen if" basis, and this is fully accomplished in this problem.

V. CONCLUSION

A personnel system is simulated so that the personnel planner can use this simulation as a tool to help solve manpower problems utilizing the benefits of a computer. The input parameters are time in grade and time in the system of each individual, the manpower requirements in each grade, annual input to the system, and the number of years to run the simulation.

The dynamic properties of the simulation are loss rates and promotion rates. A decision maker runs the model to determine the effects of changes in the input parameters.

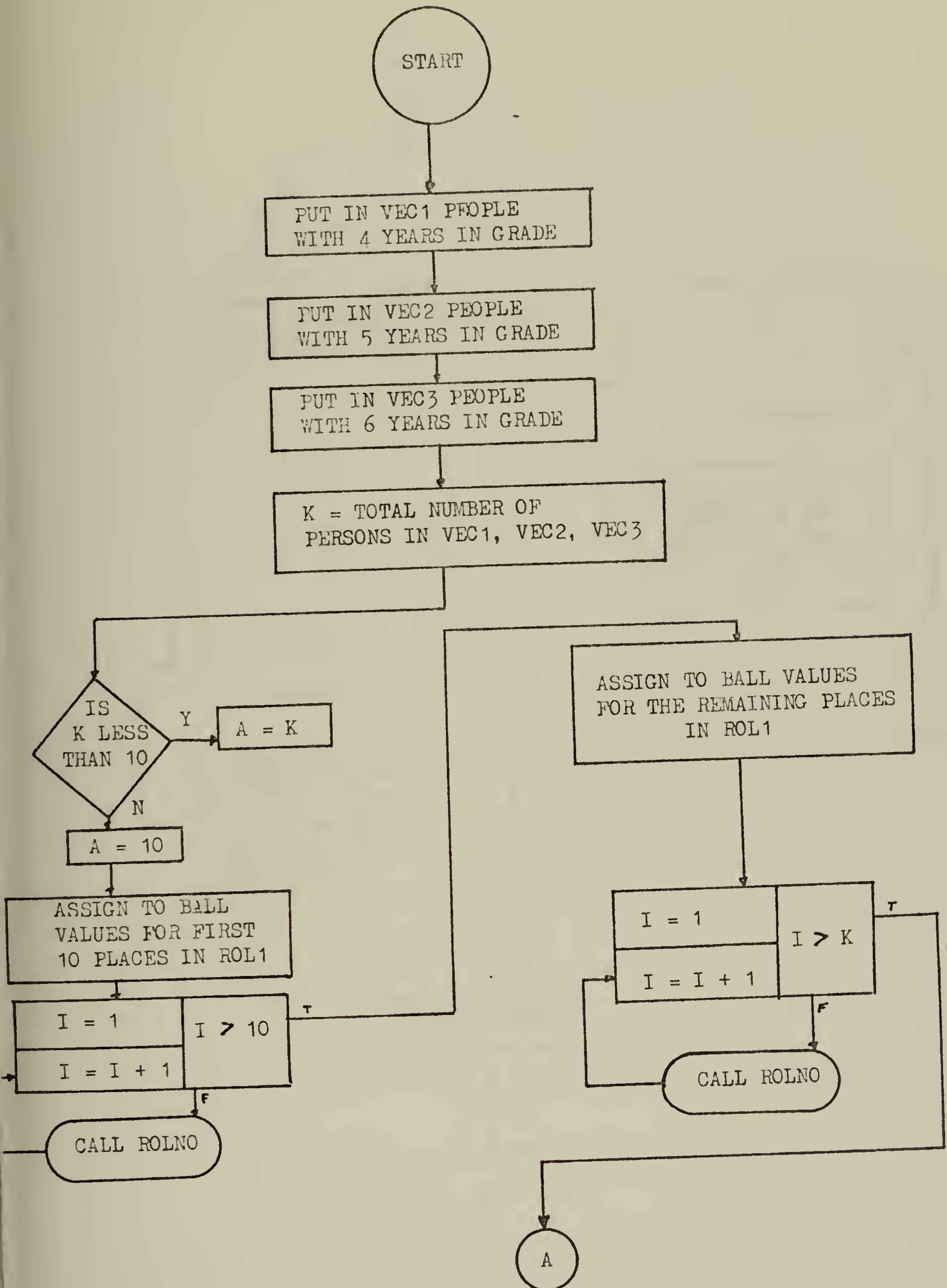
A sample problem was presented. Flowcharts and a listing of the Fortran program are included in the appendixes.

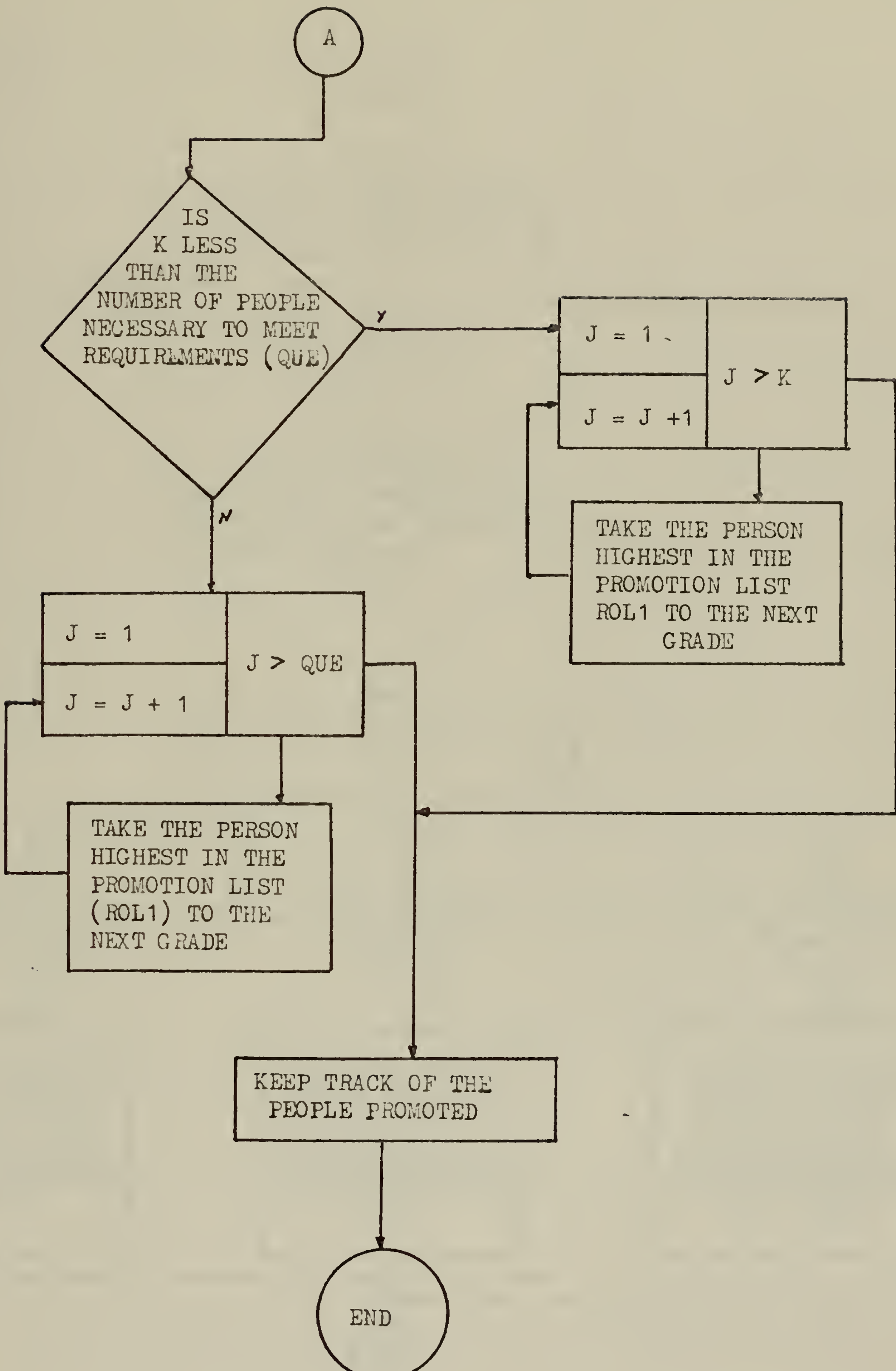
This model is designed to be very flexible. Therefore, for a system with the same structure as the one described in this paper, but with different rates of losses or different rates of promotion, it can be easily implemented because the subroutines that perform these functions can be very easily adapted or modified.

After the model is ready for use, it is up to the imagination of the programmer to build the experiment and be able to have the desired output--in other words, be able to answer the personnel planner's question.

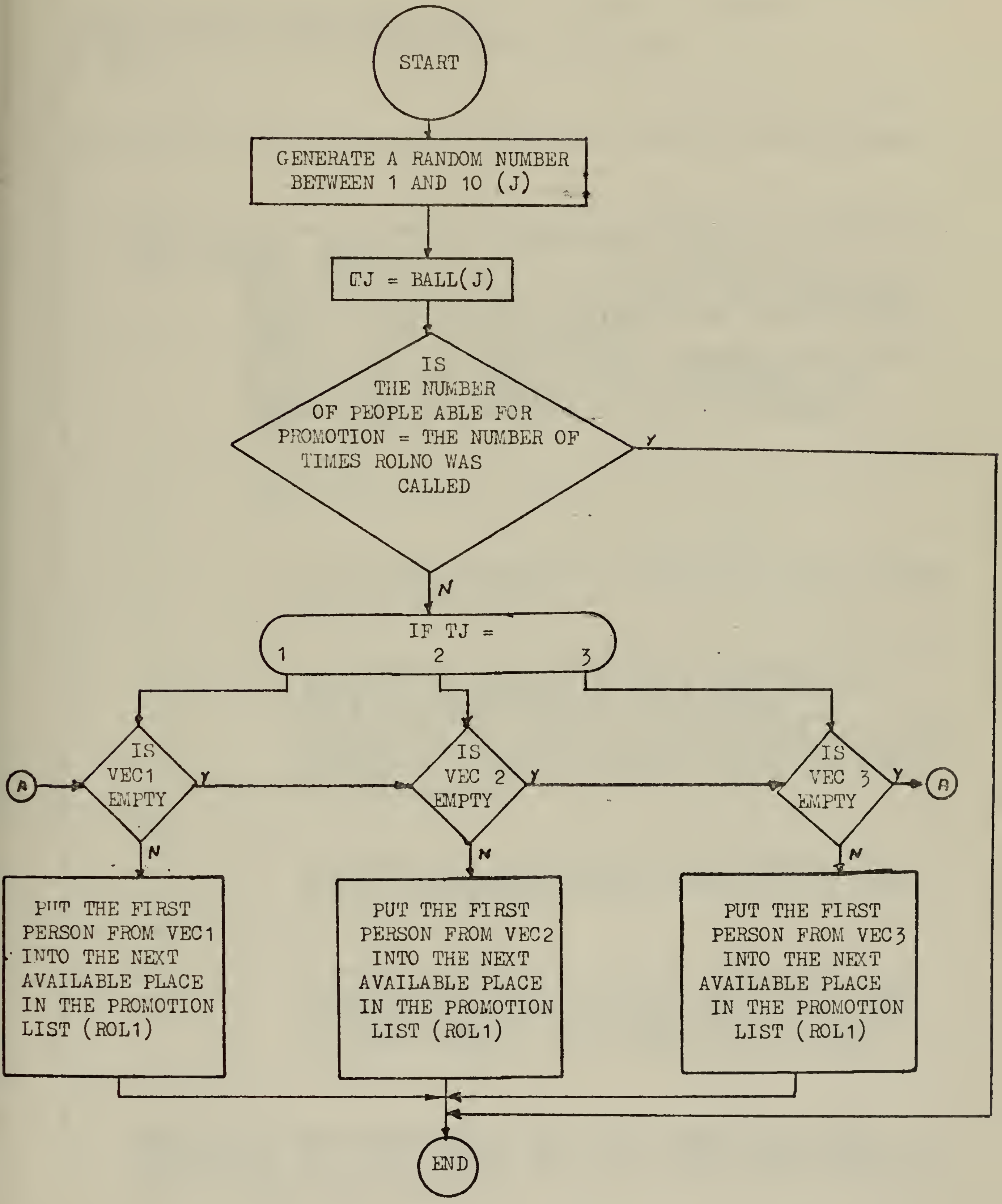
Any experiment using a computer simulation is still an art and a very interesting field of investigation. I encourage students to continue investigating this exciting part of computer science.

APPENDIX A PROMOTION ALGORITHM




A
IS K LESS THAN THE NUMBER OF PEOPLE NECESSARY TO MEET REQUIREMENTS (QUE)
Y
N
J = 1
J = J +1
J > K
TAKE THE PERSON HIGHEST IN THE PROMOTION LIST ROL1 TO THE NEXT GRADE
J = 1
J = J + 1
J > QUE
TAKE THE PERSON HIGHEST IN THE PROMOTION LIST (ROL1) TO THE NEXT GRADE
KEEP TRACK OF THE PEOPLE PROMOTED
END

APPENDIX B SUBROUTINE ROLNO (Input Parameters I, BALL)



APPENDIX C COMPUTER PROGRAM

```
C
C
C
C
C
C
//VARG2296 JOB (2296,0900FT,CS14),'VARGAS L',TIME=1
// EXEC FORTCLG,REGION.GO=110K
//FORT.SYSIN DD DSNAME=SSP3(PLOTP),DISP=SHR
// DD *
C
C
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C
C
C
C     THIS IS A SIMULATION OF A PERSONNEL SYSTEM , IT CONSISTS
C     OF A MONITOR PROGRAM AND THREE MAJOR SUBROUTINES
C     OUT, AVANCE, OUTPUT.
C             OUT. CALCULATES ALL THE LOSSES TO THE SYSTEM.
C             AVANCE. COMPUTES THE PEOPLE ABLE FOR PROMOTION,
C             PROMOTES THE NECESSARY NUMBER, AND ADVANCES ONE
C             YEAR IN TIME ALL THE FORCE.
C             OUTPUT. IS A SUBROUTINE THAT MANAGES THE OUTPUT
C             OF THE PROGRAM, THIS OUTPUT IS PRODUCED IN
C             FOUR FORMS. TO PRODUCE ANY OF THE DIFFERENT
C             OUTPUTS ONE HAS TO CALL IT WITH THE NUMBER
C             1, 3, 4 OR 5.
C
C
C             THE NUMBER:
C
C
C
C
C                 1 PRODUCES AN OUTPUT LISTING ALL THE CONTENTS
C                 OF THE DATA BASE.
C
C
C
C                 3 PRODUCES A PLOTTING FOR EACH GRADE OF THE
C                 QUANTITY OF PEOPLE IN THE Y AXIS AND THE
C                 YEAR OF SIMULATION IN THE X AXIS.
C                 THIS CALL HAS TO BE AT THE END OF THE
C                 SIMULATION BUT IN ORDER TO FILL THE NECESSARY
C                 VECTORS OF INFORMATION ONE HAS TO CALL THIS
C                 SUBROUTINE WITH THE NUMBER 2 EACH CYCLE OF
C                 THE SIMULATION.
C
C
C
C                 4 PRODUCES A TABLE SHOWING THE NUMBER OF
C                 PEOPLE PROMOTED FROM ONE GRADE TO THE NEXT
C                 EACH YEAR OF SIMULATION.
C
C
C
C                 5 PRODUCES A LISTING OF THE VALUES OF
C                 REQUIREMENTS IN EACH GRADE EACH YEAR, THE
C                 VALUE OF THE INPUT TO THE SYSTEM EACH YEAR,
C                 THE CYCLE NUMBER, AND THE NUMBER OF CADETS
C                 IN EACH YEAR OF THE ACADEMY, EACH YEAR.
C
C
C
C
C     THE VECTOR AFRA REPRESENTS THE FIRST GRADE P1, TESE
C     REPRESENTS P2, TEPRI REPRESENTS P3, CORBE REPRESENTS P4
C     CAFRA REPRESENTS P5, CANAV REPRESENTS P6, CALM REPRESENTS
C     P7, AND VALM REPRESENTS P8.
```

```
C
C
C     THE SUBROUTINE AVANCE CALLS THE SUBROUTINES PROL, SROL,
C     TROL, CROL, QROL, SROL, SEROL.
C     EACH OF THESE SUBROUTINES CALLS SUBROUTINE ROLNO TO PERFORM
C     THE FUNCTION OF FORMING THE PROMOTION LIST FOR EACH GRADE
C    WHICH SUBROUTINE AVANCE NEEDS TO PROMOTE THE NECESSARY
C     PEOPLE TO MEET REQUIREMENTS.
C
C     THESE SEVEN SUBROUTINE , ONE FOR EACH GRADE EXCEPT P8
C     BECAUSE THERE IS NO PROMOTION FROM P8, DETERMINES IN A
C     PROBABILISTIC MANNER THE ORDER IN THE PROMOTION LIST OF
C     THE PEOPLE ABLE FOR PROMOTION.
C
C
C
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C
C
C
C
C
C     MONITOR PROGRAM     PROGRAMA MONITOR
C
C
C
C
C
C
      IMPLICIT INTEGER(A-Y)
      COMMON/NADA/ AFRA(200), TESE(200), TEPRI(200),
     1CORBE(150), CAFRA(100),CANAV(80), CALM(50), VALM(10),
     2ENTA(10),ENTB(50),ENTC(80),ENTD(100),ENTE(150),
     3ENTF(200),ENTG(200),ENTH(200),QUE1,QUE2,QUE3,
     4QUE4,QUE5,QUE6,QUE7,QUE8,VEC1(200),VEC2(200),
     5VEC3(200),ROL1(600),IX,K1,K3,K2,KK,LL,MM,INGO,
     6CADET(5),REKIS(8),CY,Z1(100),A1(50),A2(50),A3(50),
     7A4(50),A5(50),A6(50),A7(50),CYCLE
      DO 10 I=1,200
      READ(5,100) AFRA(I)
 10   CONTINUE
      DO 11 I=1,200
      READ(5,100) TESE(I)
 11   CONTINUE
      DO 12 I=1,200
      READ(5,100) TEPRI(I)
 12   CONTINUE
      DO 13 I=1,150
      READ(5,100) CORBE(I)
 13   CONTINUE
      DO 14 I=1,100
      READ(5,100) CAFRA(I)
      Z1(I)=I
 14   CONTINUE
      DO 15 I=1,80
      READ(5,100) CANAV(I)
 15   CONTINUE
      DO 16 I=1,50
      READ(5,100) CALM(I)
 16   CONTINUE
      DO 17 I=1,10
      READ(5,100) VALM(I)
 17   CONTINUE
      DO 18 I=1,5
      READ(5,100) CADET(I)
 18   CONTINUE
      DO 19 I=1,8
      READ(5,100) REKIS(I)
 19   CONTINUE
      READ(5,100) CYCLE
      CY=CYCLE
```

```
 100   FORMAT(I4)
C
C
C     THIS PART IS DEPENDENT OF THE PARTICULAR
C     USE OF THE MODEL
C
C     ESTA PARTE ES DEPENDIENTE DE LO QUE SE QUIERA
C     HACER CON EL MODELO
C
C
 1000  CALL OUTPUT(2)
       READ(5,100) INGO
       CALL OUTPUT(5)
       CALL OUT
       CALL AVANCE
       CYCLE=CYCLE-1
       IF(CYCLE.EQ.25) GO TO 1001
       IF(CYCLE.NE.0) GO TO 1000
       GO TO 1002
 1001  REKIS(6)=180
       REKIS(7)=160
       REKIS(8)=160
       GO TO 1000
 1002  CALL OUTPUT(3)
       CALL OUTPUT(4)
       STOP
       END
C
C
C
C


       SUBROUTINE OUTPUT(NO)
C
C
C
C
C
C     THIS SUBROUTINE DRIVES ALL THE OUTPUTS OF THE PROGRAM
C
C     ESTA SUBRUTINA MANEJA TODO LO QUE SE VA A IMPRIMIR
C
       IMPLICIT INTEGER(A-Y)
       COMMON/NADA/ AFRA(200), TESE(200), TEPRI(200),
      1CORBE(150), CAFRA(100),CANAV(80), CALM(50), VALM(10),
      2ENTA(10),ENTB(50),ENTC(80),ENTD(100),ENTE(150),
      3ENTF(200),ENTG(200),ENTH(200),QUE1,QUE2,QUE3,
      4QUE4,QUE5,QUE6,QUE7,QUE8,VEC1(200),VEC2(200),
      5VEC3(200),ROL1(600),IX,K1,K3,K2,KK,LL,MM,INGO,
      6CADET(5),REKIS(8),CY,Z1(100),A1(50),A2(50),A3(50),
      7A4(50),A5(50),A6(50),A7(50),CYCLE
       DIMENSION Z2(100),Z3(100),Z4(100),Z5(100),Z6(100),
      1Z7(100),Z8(100),Z9(100)
C
C
C
       GO TO (11,12,13,14,15),NO
 11    WRITE(6,107)
       DO 1 I=1,10
       WRITE(6,101) AFRA(I),TESE(I),TEPRI(I),CORBE(I),
      1CAFRA(I),CANAV(I),CALM(I),VALM(I)
 1     CONTINUE
       DO 2 I=11,50
       WRITE(6,102) AFRA(I),TESE(I),TEPRI(I),CORBE(I),
      1CAFRA(I),CANAV(I),CALM(I)
 2     CONTINUE
       DO 3 I=51,80
       WRITE(6,103) AFRA(I),TESE(I),TEPRI(I),CORBE(I),
      1CAFRA(I),CANAV(I)
 3     CONTINUE
       DO 4 I=81,100
```

```
      WRITE(6,104) AFRA(I),TESE(I),TEPRI(I),CORBE(I),
     1CAFRA(I)
4     CONTINUE
      DO 5 I=101,150
      WRITE(6,105) AFRA(I),TESE(I),TEPRI(I),CORBE(I)
5     CONTINUE
      DO 6 I=151,200
      WRITE(6,106) AFRA(I),TESE(I),TEPRI(I)
6     CONTINUE
      WRITE(6,108)
41    DO 7 I=1,5
      WRITE(6,109) CADET(I)
7     CONTINUE
      WRITE (6,110)
      DO 8 I=1,8
      WRITE(6,109) REKIS(I)
8     CONTINUE
      WRITE(6,111) INGO
      WRITE(6,112) CYCLE
101   FORMAT(' ',8I10)
102   FORMAT(' ',7I10)
103   FORMAT(' ',6I10)
104   FORMAT(' ',5I10)
105   FORMAT(' ',4I10)
106   FORMAT(' ',3I10)
107   FORMAT('1','     AFRA    ','   TESE    ','   TEPRI  ',
     1'   CORBE  ',
     2'   CAFRA  ','   CANAV  ','   CALM    ','   VALM    ')
108   FORMAT(' ',' CADET ')
109   FORMAT(' ',I10)
110   FORMAT(' ',' REKIS ')
111   FORMAT(' ',' INGO = ',I10)
112   FORMAT(' ',' CYCLE = ',I10)
      RETURN
12    VA=0
      CA=0
      CN=0
      CF=0
      CO=0
      TP=0
      TS=0
      AF=0
      DO 21 I=1,10
      IF(VALM(I).GT.0) VA=VA+1
21    CONTINUE
      DO 22 I=1,50
      IF(CALM(I).GT.0) CA=CA+1
22    CONTINUE
      DO 23 I=1,80
      IF(CANAV(I).GT.0) CN=CN+1
23    CONTINUE
      DO 24 I=1,100
      IF(CAFRA(I).GT.0) CF=CF+1
24    CONTINUE
      DO 25 I=1,150
      IF(CORBE(I).GT.0) CO=CO+1
25    CONTINUE
      DO 26 I=1,200
      IF(TEPRI(I).GT.0) TP=TP+1
      IF(TESE(I).GT.0) TS=TS+1
      IF(AFRA(I).GT.0) AF=AF+1
26    CONTINUE
      Z2(CY-CYCLE+1)=VA
      Z3(CY-CYCLE+1)=CA
      Z4(CY-CYCLE+1)=CN
      Z5(CY-CYCLE+1)=CF
      Z6(CY-CYCLE+1)=CO
      Z7(CY-CYCLE+1)=TP
      Z8(CY-CYCLE+1)=TS
      Z9(CY-CYCLE+1)=AF
      RETURN
13    WRITE(6,113)
```

```
113   FORMAT('1',' VICEALMIRANTES  (VALM) ')
      CALL PLOTP(Z1,Z2,CY,0)
      WRITE(6,114)
114   FORMAT('1',' CONTALMIRANTES  (CALM )')
      CALL PLOTP(Z1,Z3,CY,0)
      WRITE(6,115)
115   FORMAT('1',' CAPITANES DE NAVIO  (CANAV) ')
      CALL PLOTP(Z1,Z4,CY,0)
      WRITE(6,116)
116   FORMAT('1',' CAPITANES DE FRAGATA  (CAFRA) ')
      CALL PLOTP(Z1,Z5,CY,0)
      WRITE(6,117)
117   FORMAT('1',' CAPITANES DE CORBETA (CORBE) ')
      CALL PLOTP(Z1,Z6,CY,0)
      WRITE(6,118)
118   FORMAT('1',' TENIENTES PRIMEROS (TEPRI) ')
      CALL PLOTP(Z1,Z7,CY,0)
      WRITE(6,119)
C
119   FORMAT('1',' TENIENTES SEGUNDOS  (TESE) ')
      CALL PLOTP(Z1,Z8,CY,0)
      WRITE(6,120)
120   FORMAT('1',' ALFERECES DE FRAGATA  (AFRA) ')
      CALL PLOTP(Z1,Z9,CY,0)
      RETURN
14    WRITE(6,121)
      DO 31 I=1,CY
      WRITE(6,122)A1(I),A2(I),A3(I),A4(I),A5(I),
     1A6(I),A7(I)
31    CONTINUE
121   FORMAT('1','CALM TO VALM  ','CANAV TO CALM  ',
     1'CAFRA TO CANAV  ','CORBE TO CAFRA  ',
     2'TEPRI TO CORBE  ','TESE TO TEPRI  ',
     3'AFRA TO TESE  ')
122   FORMAT('0',I7,6I16)
      RETURN
15    CY=CY
      GO TO 41
      END
C
C
C
C
C
C
C
C


      SUBROUTINE OUT
C
C
C
C     THIS SUBROUTINE CCMPUTES ALL THE LOSSES
C
C     ESTA SUBRUTINA COMPUTA TODAS LAS PERDIDAS DEL SISTEMA
C
C
C
C
      IMPLICIT INTEGER(A-Y)
      COMMON/NADA/ AFRA(200), TESE(200), TEPRI(200),
     1CORBE(150), CAFRA(100),CANAV(80), CALM(50), VALM(10),
     2ENTA(10),ENTB(50),ENTC(80),ENTD(100),ENTE(150),
     3ENTF(200),ENTG(200),ENTH(200),QUE1,QUE2,QUE3,
     4QUE4,QUE5,QUE6,QUE7,QUE8,VEC1(200),VEC2(200),
     5VEC3(200),ROL1(600),IX,K1,K3,K2,KK,LL,MM,INGO,
     6CADET(5),REKIS(8),CY,Z1(100),A1(50),A2(50),A3(50),
     7A4(50),A5(50),A6(50),A7(50),CYCLE
      WRITE(6,200)
200   FORMAT('0','ENTRC A OUT ')
C
```

```
C     VICE-ADMIRALS
C     VICEALMIRANTES
C
      VA=0
      B=1
      DO 10 I=1,10
      A=VALM(I)
 1001 IF(A.LT.100) GO TO 1000
      A=A-100
      GO TO 1001
 1000 IF(A.LT.35) GO TO 110
      QUE1=QUE1+1
      VALM(I)=0
 110  IF( VALM(I).NE.0) VA=VA+1
      IF(VALM(I).GT.0) GO TO 10
      ENTA(B)=I
      B=B+1
 10   CONTINUE
      N=VA-QUE1
      P1=IFIX(N*0.01+1)
      I=1
      DO 11 J=1,P1
 1003 IF(VALM(I).GT.0) GO TO 1002
      I=I+1
      GO TO 1003
 1002 ENTA(B)=I
      VALM(I)=0
      B=B+1
      I=I+1
      QUE1=QUE1+1
 11   CONTINUE
C
C     REAR-ADMIRALS
C     CONTRALMIRANTES
C
      CA=0
      C=1
      DO 12 I=1,50
      A=CALM(I)
      IF(A.GE.800) GO TO 1006
 1005 IF(A.LT.100) GO TO 1004
      A=A-100
      GO TO 1005
 1004 IF(A.LT.35) GO TO 112
 1006 QUE2=QUE2+1
      CALM(I)=0
 112  IF( CALM(I).NE.0) CA=CA+1
      IF(CALM(I).GT.0) GO TO 12
      ENTB(C)=I
      C=C+1
 12   CONTINUE
      N=CA-QUE2
      P2=IFIX(N*0.02+1)
      I=1
      DO 13 J=1,P2
 1008 IF(CALM(I).GT.0) GO TO 1007
      I=I+1
      GO TO 1008
 1007 ENTB(C)=I
      C=C+1
      CALM(I)=0
      I=I+1
      QUE2=QUE2+1
 13   CONTINUE
C
C     CAPTAINS
C     CAPITANES DE NAVIO
C
      CN=0
      D=1
      DO 14 I=1,80
      A=CANAV(I)
```

```
      IF(A.GE.800) GO TO 1011
 1010 IF(A.LT.100) GO TO 1009
      A=A-100
      GO TO 1010
 1009 IF(A.LT.35) GO TO 114
 1011 QUE3=QUE3+1
      CANAV(I)=0
 114  IF(CANAV(I).NE.0) CN=CN+1
      IF(CANAV(I).GT.0) GO TO 14
      ENTC(D)=I
      D=D+1
 14   CONTINUE
      N=CN-QUE3
      P3=IFIX(N*0.02+1)
      I=1
      DO 15 J=1,P3
 1013 IF(CANAV(I).GT.0)GO TO 1012
      I=I+1
      GO TO 1013
 1012 ENTC(D)=I
      CANAV(I)=0
      D=D+1
      I=I+1
      QUE3=QUE3+1
 15   CONTINUE
C
C    COMMANDERS
C    CAPITANES DE FRAGATA
C
      CF=0
      E=1
      DO 16 I=1,100
      A=CAFRA(I)
      IF(A.GE.800) GO TO 1016
 1015 IF(A.LT.100) GO TO 1014
      A=A-100
      GO TO 1015
 1014 IF(A.LT.35) GO TO 116
 1016 QUE4=QUE4+1
      CAFRA(I)=0
 116  IF(CAFRA(I).NE.0) CF=CF+1
      IF(CAFRA(I).GT.0) GO TO 16
      ENTD(E)=I
      E=E+1
 16   CONTINUE
      N=CF -QUE4
      P4=IFIX(N*0.02+1)
      I=1
      DO 17 J=1,P4
 1018 IF(CAFRA(I).GT.0)GO TO 1017
      I=I+1
      GO TO 1018
 1017 ENTD(E)=I
      CAFRA(I)=0
      E=E+1
      I=I+1
      QUE4=QUE4+1
 17   CONTINUE
C
C    LIEUTENANT COMMANDER
C    CAPITANES DE CORBETA
C
      CO=0
      F=1
      DO 18 I=1,150
      A=CORBE(I)
      IF(A.GE.800) GO TO 1021
 1020 IF(A.LT.100) GO TO 1019
      A=A-100
      GO TO 1020
 1019 IF(A.LT.35) GO TO 118
 1021 QUE5=QUE5+1
```

```
      CORBE(I)=0
118   IF(CORBE(I).NE.0) CO=CO+1
      IF(CORBE(I).GT.0) GO TO 18
      ENTE(F)=I
      F=F+1
18    CONTINUE
      N=CO -QUE5
      P5=IFIX(N*0.02+1)
      I=1
      DO 19 J=1,P5
1023  IF(CORBE(I).GT.0)GO TO 1022
      I=I+1
      GO TO 1023
1022  ENTE(F)=I
      CORBE(I)=0
      F=F+1
      I=I+1
      QUE5=QUE5+1
19    CONTINUE
C
C     LIEUTENANT
C     TENIENTES PRIMEROS
      TP=0
      G=1
      DO 20 I=1,200
      A=TEPRI(I)
      IF(A.GE.1000) GO TO 1029
1031  IF(A.LT.100) GO TO 1030
      A=A-100
      GO TO 1031
1030  IF(A.LT.35) GO TO 120
1029  QUE6=QUE6+1
      TEPRI(I)=0
120   IF(TEPRI(I).NE.0) TP=TP+1
      IF(TEPRI(I).GT.0) GO TO 20
      ENTF(G)=I
      G=G+1
20    CONTINUE
      AA=0
      BB=0
      CC=0
      DD=0
      EE=0
      DO 21 I=1,200
      IF(TEPRI(I).GE.900) GO TO 121
      IF(TEPRI(I).GE.800) GO TO 221
      IF(TEPRI(I).GE.700) GO TO 321
      IF(TEPRI(I).GE.600) GO TO 421
      IF(TEPRI(I).GE.500) GO TO 521
121   AA=AA+1
      GO TO 21
221   BB=BB+1
      GO TO 21
321   CC=CC+1
      GO TO 21
421   DD=DD+1
      GO TO 21
521   EE=EE+1
21    CONTINUE
      P5=IFIX(AA*0.8+1)
      P6=IFIX(BB*0.8+1)
      P7=IFIX(CC*0.1+1)
      P8=IFIX(DD*0.20+1)
      P9=IFIX(EE*0.30+1)
      J=0
      DO 22 I=1,200
      IF(TEPRI(I).EQ.0) GO TO 22
      IF(TEPRI(I).LT.900) GO TO 22
      IF(TEPRI(I).GT.935) GO TO 22
      J=J+1
      IF(J.GT.P5) GO TO 28
      QUE6=QUE6+1
```

```
      TEPRI(I)=0
      ENTF(G)=I
      G=G+1
 22   CONTINUE
      J=0
 28   DO 23 I=1,200
      IF(TEPRI(I).EQ.0) GO TO 23
      IF(TEPRI(I).LT.800) GO TO 23
      IF(TEPRI(I).GT.835) GO TO 23
      J=J+1
      IF(J.GT.P6) GO TO 29
      QUE6=QUE6+1
      TEPRI(I)=0
      ENTF(G)=I
      G=G+1
 23   CONTINUE
      J=0
 29   DO 24 I=1,200
      IF(TEPRI(I).EQ.0) GO TO 24
      IF(TEPRI(I).LT.700) GO TO 24
      IF(TEPRI(I).GT.735) GO TO 24
      J=J+1
      IF(J.GT.P7) GO TO 33
      QUE6=QUE6+1
      TEPRI(I)=0
      ENTF(G)=I
      G=G+1
 24   CONTINUE
      J=0
 33   DO 25 I=1,200
      IF(TEPRI(I).EQ.0) GO TO 25
      IF(TEPRI(I).LT.600) GO TO 25
      IF(TEPRI(I).GT.635) GO TO 25
      J=J+1
      IF(J.GT.P8) GO TO 34
      QUE6=QUE6+1
      TEPRI(I)=0
      ENTF(G)=I
      G=G+1
 25   CONTINUE
      J=0
 34   DO 26 I=1,200
      IF(TEPRI(I).EQ.0) GO TO 26
      IF(TEPRI(I).LT.500) GO TO 26
      IF(TEPRI(I).GT.535) GO TO 26
      J=J+1
      IF(J.GT.P9) GO TO 27
      QUE6=QUE6+1
      TEPRI(I)=0
      ENTF(G)=I
      G=G+1
 26   CONTINUE
C
C    LIEUTENANT JUNIOR GRADE
C    TENIENTES SEGUNDOS
C
 27   TS=0
      H=1
      DO 30 I=1,200
      A=TESE(I)
      IF(A.GE.600) GO TO 2000
 2002 IF(A.LT.100) GO TO 2001
      A=A-100
      GO TO 2002
 2001 IF(A.LT.35) GO TO 130
 2000 QUE7=QUE7+1
      TESE(I)=0
 130  IF( TESE(I).NE.0) TS=TS+1
      IF(TESE(I).GT.0) GO TO 30
      ENTG(H)=I
      H=H+1
 30   CONTINUE
```

```
      N=TS -QUE7
      P10=IFIX(N*0.02+1)
      I=1
      DO 31 J=1,P10
 2003 IF(TESE(I).GT.0) GO TO 2004
      I=I+1
      GO TO 2003
 2004 ENTG(H)=I
      TESE(I)=0
      H=H+1
      I=I+1
      QUE7=QUE7+1
 31   CONTINUE
C
C     ENSIGNS
C     ALFERECES
C
      AF=0
      O=1
      DO 32 I=1,200
      A=AFRA(I)
      IF(A.GE.500) GO TO 2005
 2006 IF(A.LT.100) GO TO 2007
      A=A-100
      GO TO 2006
 2007 IF(A.LT.35) GO TO 132
 2005 QUE8=QUE8+1
      AFRA(I)=0
 132  IF(AFRA(I).NE.0) AF=AF+1
      IF(AFRA(I).GT.0) GO TO 32
 32   CONTINUE
      WRITE(6,201)
 201  FORMAT('0',' SALGO DE OUT ')
      RETURN
      END
C
C
C
C
C


      SUBROUTINE AVANCE
C
C
C
C     THIS SUBROUTINE COMPUTES THE PEOPLE ABLE TO
C     PROMOTION AND PROMOTES THE NECESSARY NUMBER
C     AND ADVENCES ONE YEAR IN TIME ALL THE FORCE
C
C
C     ESTA SUBRUTINA COMPUTA TODA LA GENTE ELEGIBLE PARA
C     ASCENSO Y ASCIENDE A LOS NECESARIOS Y AVANZA UN ANO
C     EN TIEMPO A TODA LA FUERZA.
C
      IMPLICIT INTEGER(A-Y)
      COMMON/NADA/ AFRA(200), TESE(200), TEPRI(200),
     1CORBE(150), CAFRA(100),CANAV(80), CALM(50), VALM(10),
     2ENTA(10),ENTB(50),ENTC(80),ENTD(100),ENTE(150),
     3ENTF(200),ENTG(200),ENTH(200),QUE1,QUE2,QUE3,
     4QUE4,QUE5,QUE6,QUE7,QUE8,VEC1(200),VEC2(200),
     5VEC3(200),ROL1(600),IX,K1,K3,K2,KK,LL,MM,INGO,
     6CADET(5),REKIS(8),CY,Z1(100),A1(50),A2(50),A3(50),
     7A4(50),A5(50),A6(50),A7(50),CYCLE
C
C
C
C     ADVANCE ONE YEAR THE VICE-ADMIRALS
C     SE AVANZA 1 ANO A LOS VICEALMIRANTES
C
C
```

```
      WRITE(6,202)
 202  FORMAT('0',' ENTRO A AVANCE ')
      VA=0
      DO 1 I=1,10
      IF(VALM(I).GT.0) VALM(I)=VALM(I)+101
      IF(VALM(I).GT.0) VA=VA+1
 1    CONTINUE
C
C
C
C     FORM THE PROMOTION LIST OF THE REAR ADMIRALS
C
C     FORMAR CUADRO DE ASCENSO DE CONTRALMIRANTES
C
C
C     IN VEC1 ARE ALL THE ONES WHO HAVE 4 YEARS IN THE GRADE
C     EN VEC1 ESTAN LOS QUE TIENEN 4 ANOS EN EL GRADO
C
C
      CA=0
      K1=1
      K2=1
      K3=1
      DO 10 I=1,50
      IF(CALM(I).LT.400) GO TO 11
      IF(CALM(I).GT.435) GO TO 11
      VEC1(K1)=I
      K1=K1+1
      GO TO 110
C
C
C     IN VEC2 ARE ALL THE ONES WHO HAVE 5 YEARS IN THE GRADE
C     EN VEC2 ESTAN TODOS LOS QUE TIENEN 5 ANOS EN EL GRADO
C
C
 11   IF(CALM(I).LT.500)GO TO 12
      IF(CALM(I).GT.535) GO TO 12
      VEC2(K2)=I
      K2=K2+1
      GO TO 110
C
C
C     IN VEC3 ARE ALL THE CNES WHO HAVE 6 YEARS IN THE GRADE
C     EN VEC3 ESTAN TODOS LOS QUE TIENEN 6 ANOS EN EL GRADO
C
C
 12   IF(CALM(I).LT.600)GO TO 110
      IF(CALM(I).GT.635) GO TO 110
      VEC3(K3)=I
      K3=K3+1
C
C     ADVANCE ONE YEAR THE REAR-ADMIRALS
C
 110  IF(CALM(I).GT.0) CALM(I)=CALM(I)+101
      IF(CALM(I).GT.0) CA=CA+1
 10   CONTINUE
      K=K1+K2+K3-3
C
C     FORM THE PROMOTION LIST AND PROMOTE -
C     THE NECESSARY NUMBER OF PEOPLE
C
C     SE FORMA EL CUADRO DE ASCENSO Y SE ASCIENDE
C     AL NUMERO NECESARIO DE GENTE
C
      RE=REKIS(1)-VA
      QUE1=RE
      CALL PROL(K)
      IF(K.LT.QUE1) GO TO 14
      CA=CA-QUE1
      A1(CY-CYCLE+1)=QUE1
      DO 13 J=1,QUE1
      TEMP1=CALM(ROL1(J))-600
```

```
      IF(TEMP1.LT.0) GO TO 18
      IF(TEMP1.GT.100) GO TO 17
      VALM(ENTA(J))=CALM(ROL1(J))-500
      CALM(ROL1(J))=0
      GO TO 13
18    VALM(ENTA(J))=CALM(ROL1(J))-400
      CALM(ROL1(J))=0
      GO TO 13
17    VALM(ENTA(J))=CALM(ROL1(J))-600
      CALM(ROL1(J))=0
13    CONTINUE
      QUE2=QUE2+QUE1
      GO TO 16
14    DO 15 J=1,K
      TEMP1=CALM(ROL1(J))-600
      IF(TEMP1.LT.0) GO TO 19
      IF(TEMP1.GT.100) GO TO 117
      VALM(ENTA(J))=CALM(ROL1(J))-500
      CALM(ROL1(J))=0
      GO TO 15
19    VALM(ENTA(J))=CALM(ROL1(J))-400
      CALM(ROL1(J))=0
      GO TO 15
117   VALM(ENTA(J))=CALM(ROL1(J))-600
      CALM(ROL1(J))=0
15    CONTINUE
      CA=CA-K
      A1(CY-CYCLE+1)=K
      QUE2=QUE2+K
16    O=1
      DO 116 I=1,50
      IF(CALM(I).GT.0) GO TO 116
      ENTB(O)=I
      O=O+1
116   CONTINUE
C
C     FORM THE PROMOTION LIST OF THE CAPTAINS
C
C     FORMAR CUADRO DE ASCENSO DE CAPITANES DE NAVIO
C
C
      KK=1
      LL=1
      MM=1
C
C     IN VEC1 ARE ALL THE ONES WHO HAVE 4 YEARS IN THE GRADE
C
C     EN VEC1 ESTAN TODOS LOS QUE TIENEN 4 ANOS EN EL GRADO
C
C
      CN=0
      K1=1
      K2=1
      K3=1
      DO 20 I=1,80
      IF(CANAV(I).LT.400) GO TO 21
      IF(CANAV(I).GT.435) GO TO 21
      VEC1(K1)=I
      K1=K1+1
      GO TO 220
C
C
C     IN VEC2 ARE ALL THE ONES WHO HAVE 5 YEARS IN THE GRADE
C
C     EN VEC2 ESTAN TODOS LOS QUE TIENEN 5 ANOS EN EL GRADO
C
C
21    IF(CANAV(I).LT.500) GO TO 22
      IF(CANAV(I).GT.535) GO TO 22
      VEC2(K2)=I
      K2=K2+1
      GO TO 220
```

```
C
C     IN VEC3 ARE ALL THE ONES WHO HAVE 6 YEARS IN THE GRADE
C
C     EN VEC3 ESTAN TODOS LOS QUE TIENEN 6 ANOS EN EL GRADO
C
C
 22    IF(CANAV(I).LT.600) GO TO 220
       IF(CANAV(I).GT.635) GO TO 220
       VEC3(K3)=I
       K3=K3+1
C
C     ADVANCE ONE YEAR THE CAPTAINS
C
 220   IF(CANAV(I).GT.0) CANAV(I)=CANAV(I)+101
       IF(CANAV(I).GT.0) CN=CN+1
 20    CONTINUE
       K=K1+K2+K3-3
       IF(REKIS(2).GT.QUE2) QUE2=REKIS(2)
C
C     FORM THE PROMOTION LIST AND PROMOTE
C     THE NECESSARY NUMBER OF PEOPLE
C
C     SE FORMA EL CUADRO DE ASCENSO Y SE ASCIENDE
C     AL NUMERO NECESARIO DE GENTE
C
       RE=REKIS(2)-CA
       QUE2=RE
       CALL SROL(K)
       IF(K.LT.QUE2) GO TO 24
       CN=CN-QUE2
       A2(CY-CYCLE+1)=QUE2
       DO 23 J=1,QUE2
       TEMP1=CANAV(ROL1(J))-600
       IF(TEMP1.LT.0) GO TO 28
       IF(TEMP1.GT.100) GO TO 27
       CALM(ENTB(J))=CANAV(ROL1(J))-500
       CANAV(ROL1(J))=0
       GO TO 23
 28    CALM(ENTB(J))=CANAV(ROL1(J))-400
       CANAV(ROL1(J))=0
       GO TO 23
 27    CALM(ENTB(J))=CANAV(ROL1(J))-600
       CANAV(ROL1(J))=0
 23    CONTINUE
       QUE3=QUE3+QUE2
       GO TO 26
 24    DO 25 J=1,K
       TEMP1=CANAV(ROL1(J))-600
       IF(TEMP1.LT.0) GO TO 29
       IF(TEMP1.GT.100) GO TO 227
       CALM(ENTB(J))=CANAV(ROL1(J))-500
       CANAV(ROL1(J))=0
       GO TO 25
 29    CALM(ENTB(J))=CANAV(ROL1(J))-400
       CANAV(ROL1(J))=0
       GO TO 25
 227   CALM(ENTB(J))=CANAV(ROL1(J))-600
       CANAV(ROL1(J))=0
 25    CONTINUE
       CN=CN-K
       A2(CY-CYCLE+1)=K
       QUE3=QUE3+K
 26    O=1
       DO 216 I=1,80
       IF(CANAV(I).GT.0) GO TO 216
       ENTC(O)=I
       O=O+1
 216   CONTINUE
C
C     FORM THE PROMOTION LIST OF THE COMMANDERS
C
C     FORMAR CUADRO DE ASCENSO DE CAPITANES DE FRAGATA
```

```
C
      KK=1
      LL=1
      MM=1
C
C     IN VEC1  ARE  ALL  THE  ONES  WHO  HAVE  4  YEARS  IN  THE  GRADE
C
C     EN VEC1  ESTAN  TODOS  LOS  QUE  TIENEN  4  ANOS  EN  EL  GRADO
      CF=0
      K1=1
      K2=1
      K3=1
      DO 30 I=1,100
      IF(CAFRA(I).LT.400) GO TO 31
      IF(CAFRA(I).GT.435) GO TO 31
      VEC1(K1)=I
      K1=K1+1
      GO TO 330
C
C     IN  VEC2  ARE  ALL  THE  ONES  WHO  HAVE  5  YEARS  IN  THE  GRADE
C
C     EN  VEC2  ESTAN  TODOS  LOS  QUE  TIENEN  5  ANOS  EN  EL  G
C
 31   IF(CAFRA(I).LT.500) GO TO 32
      IF(CAFRA(I).GT.535) GO TO 32
      VEC2(K2)=I
      K2=K2+1
      GO TO 330
C
C     IN  VEC3  ARE  ALL  THE  ONES  WHO  HAVE  6  YEARS  IN  THE  GRADE
C
C     EN  VEC3  ESTAN  TODOS  LOS  QUE  TIENEN  6  ANOS  EN  EL  GRADO
C
 32   IF(CAFRA(I).LT.600) GO TO 330
      IF(CAFRA(I).GT.635) GO TO 330
      VEC3(K3)=I
      K3=K3+1
C
C     ADVANCE  ONE  YEAR  THE  COMMANDERS
C
 330  IF(CAFRA(I).GT.0) CAFRA(I)=CAFRA(I)+101
      IF(CAFRA(I).GT.0) CF=CF+1
 30   CONTINUE
      K=K1+K2+K3-3
      IF(REKIS(3).GT.QUE3) QUE3=REKIS(3)
C
C     FORM  THE  PROMOTION  LIST  AND  PROMOTE
C     THE  NECESSARY  NUMBER  OF  PEOPLE
C
C     SE  FORMA  EL  CUADRO  DE  ASCENSO  Y  SE  ASCIENDE
C     AL  NUMERO  NECESARIO  DE  GENTE
C
C
      RE=REKIS(3)-CN
      QUE3=RE
      CALL TROL(K)
      IF(K.LT.QUE3) GO TO 34
      CF=CF-QUE3
      A3(CY-CYCLE+1)=QUE3
      DO 33 J=1,QUE3
      TEMP1=CAFRA(ROL1(J))-600
      IF(TEMP1.LT.0) GO TO 38
      IF(TEMP1.GT.100) GO TO 37
      CANAV(ENTC(J))=CAFRA(ROL1(J))-500
      CAFRA(ROL1(J))=0
      GO TO 33
 38   CANAV(ENTC(J))=CAFRA(ROL1(J))-400
      CAFRA(ROL1(J))=0
      GO TO 33
 37   CANAV(ENTC(J))=CAFRA(ROL1(J))-600
      CAFRA(ROL1(J))=0
 33   CONTINUE
```

```
      QUE4=QUE4+QUE3
      GO TO 36
 34   DO 35 J=1,K
      TEMP1=CAFRA(ROL1(J))-600
      IF(TEMP1.LT.0) GO TO 39
      IF(TEMP1.GT.100) GO TO 337
      CANAV(ENTC(J))=CAFRA(ROL1(J))-500
      CAFRA(ROL1(J))=0
      GO TO 35
 39   CANAV(ENTC(J))=CAFRA(ROL1(J))-400
      CAFRA(ROL1(J))=0
      GO TO 35
 337  CANAV(ENTC(J))=CAFRA(ROL1(J))-600
      CAFRA(ROL1(J))=0
 35   CONTINUE
      CF=CF-K
      A3(CY-CYCLE+1)=K
      QUE4=QUE4+K
 36   O=1
      DO 316 I=1,100
      IF(CAFRA(I).GT.0) GO TO 316
      ENTD(O)=I
      O=O+1
 316  CONTINUE
C
C
C     FORM THE PROMOTION LIST OF THE LIEUTENANT COMMANDERS
C
C     FORMAR EL CUADRO DE ASCENSO DE CAPITANES DE CORBETA
C
C
C
C
      KK=1
      LL=1
      MM=1
C
C     IN VEC1 ARE ALL THE ONES WHO HAVE 4 YEARS IN THE GRADE
C
C     EN VEC1 ESTAN LOS QUE TIENEN 4 ANOS EN EL GRADO
C
C
      CO=0
      K1=1
      K2=1
      K3=1
      DO 40 I=1,150
      IF(CORBE(I).LT.400) GO TO 41
      IF(CORBE(I).GT.435) GO TO 41
      VEC1(K1)=I
      K1=K1+1
      GO TO 440
C
C     IN VEC2 ARE ALL THE ONES WHO HAVE 5 YEARS IN THE GRADE
C
C     EN VEC2 ESTAN LOS QUE TIENEN 5 ANOS EN EL GRADO
C
 41   IF(CORBE(I).LT.500) GO TO 42
      IF(CORBE(I).GT.535) GO TO 42
      VEC2(K2)=I
      K2=K2+1
      GO TO 440
C
C     IN VEC3 ARE ALL THE ONES WHO HAVE 6 YEARS IN THE GRADE
C
C     EN VEC3 ESTAN LOS QUE TIENEN 6 ANOS EN EL GRADO
C
 42   IF(CORBE(I).LT.600) GO TO 440
      IF(CORBE(I).GT.635) GO TO 440
      VEC3(K3)=I
      K3=K3+1
C
```

```
C     ADVANCE ONE YEAR THE LIEUTENANT COMMANDER
C
 440   IF(CORBE(I).GT.0) CORBE(I)=CORBE(I)+101
       IF(CORBE(I).GT.0) CO=CO+1
 40    CONTINUE
       K=K1+K2+K3-3
       IF(REKIS(4).GT.QUE4) QUE4=REKIS(4)
C
C     FORM THE PROMOTION LIST AND PROMOTE
C     THE NECESSARY NUMBER OF PEOPLE
C
C     SE FORMA EL CUADRO DE ASCENSO Y SE ASCIENDE
C     AL NUMERO NECESARIO DE GENTE
C
C
       RE=REKIS(4)-CF
       QUE4=RE
       CALL CROL(K)
       IF(K.LT.QUE4) GO TO 44
       CO=CO-QUE4
       A4(CY-CYCLE+1)=QUE4
       DO 43 J=1,QUE4
       TEMP1=CORBE(ROL1(J))-600
       IF(TEMP1.LT.0) GO TO 48
       IF(TEMP1.GT.100) GO TO 47
       CAFRA(ENTD(J))=CORBE(ROL1(J))-500
       CORBE(ROL1(J))=0
       GO TO 43
 48    CAFRA(ENTD(J))=CORBE(ROL1(J))-400
       CORBE(ROL1(J))=0
       GO TO 43
 47    CAFRA(ENTD(J))=CORBE(ROL1(J))-600
       CORBE(ROL1(J))=0
 43    CONTINUE
       QUE5=QUE5+QUE4
       GO TO 46
 44    DO 45 J=1,K
       TEMP1=CORBE(ROL1(J))-600
       IF(TEMP1.LT.0) GO TO 49
       IF(TEMP1.GT.100) GO TO 447
       CAFRA(ENTD(J))=CORBE(ROL1(J))-500
       CORBE(ROL1(J))=0
       GO TO 45
 49    CAFRA(ENTD(J))=CORBE(ROL1(J))-400
       CORBE(ROL1(J))=0
       GO TO 45
 447   CAFRA(ENTD(J))=CORBE(ROL1(J))-600
       CORBE(ROL1(J))=0
 45    CONTINUE
       CO=CO-K
       A4(CY-CYCLE+1)=K
       QUE5=QUE5+K
 46    O=1
       DO 416 I=1,150
       IF(CORBE(I).GT.0) GO TO 416
       ENTE(O)=I
       O=O+1
 416   CONTINUE
C
C     FORM THE PROMOTION LIST OF THE LIEUTENANT
C
C     FORMAR CUADRO DE ASCENSO DE TENIENTES PRIMEROS
C
C
C
       KK=1
       LL=1
       MM=1
C
C     IN VEC1 ARE ALL THE CNES WHO HAVE 4 YEARS IN THE GRADE
C
C     EN VEC1 ESTAN LOS QUE TIENEN 4 ANOS EN EL GRADO
```

```
C
      TP=0
      K1=1
      K2=1
      K3=1
      DO 50 I=1,200
      IF(TEPRI(I).LT.400) GO TO 51
      IF(TEPRI(I).GT.435) GO TO 51
      VEC1(K1)=I
      K1=K1+1
      GO TO 550
C
C     IN VEC2 ARE ALL THE ONES WHO HAVE 5 YEARS IN THE GRADE
C
C     EN VEC2 ESTAN LOS QUE TIENEN 5 ANOS EN EL GRADO
C
 51   IF(TEPRI(I).LT.500) GO TO 52
      IF(TEPRI(I).GT.535) GO TO 52
      VEC2(K2)=I
      K2=K2+1
      GO TO 550
C
C     IN VEC3 ARE ALL THE ONES WHO HAVE 6 YEARS IN THE GRADE
C
C     EN VEC3 ESTAN LOS QUE TIENEN 6 ANOS EN EL GRADO
C
 52   IF(TEPRI(I).LT.600) GO TO 550
      IF(TEPRI(I).GT.635) GO TO 550
      VEC3(K3)=I
      K3=K3+1
C
C     ADVANCE ONE YEAR THE LIEUTENANT
C
 550  IF(TEPRI(I).GT.0) TEPRI(I)=TEPRI(I)+101
      IF(TEPRI(I).GT.0) TP=TP+1
 50   CONTINUE
      K=K1+K2+K3-3
      IF(REKIS(5).GT.QUE5) QUE5=REKIS(5)
C
C     FORM THE PROMOTION LIST AND PROMOTE
C     THE NECESSARY NUMBER OF PEOPLE
C
C     SE FORMA EL CUADRO DE ASCENSO Y SE ASCIENDE
C     AL NUMERO NECESARIO DE GENTE
C
C
      RE=REKIS(5)-CO
      QUE5=RE
      CALL QROL(K)
      IF(K.LT.QUE5) GO TO 54
      TP=TP-QUE5
      A5(CY-CYCLE+1)=QUE5
      DO 53 J=1,QUE5
      TEMP1=TEPRI(ROL1(J))-600
      IF(TEMP1.LT.0) GO TO 58
      IF(TEMP1.GT.100) GO TO 57
      CORBE(ENTE(J))=TEPRI(ROL1(J))-500
      TEPRI(ROL1(J))=0
      GO TO 53
 58   CORBE(ENTE(J))=TEPRI(ROL1(J))-400
      TEPRI(ROL1(J))=0
      GO TO 53
 57   CORBE(ENTE(J))=TEPRI(ROL1(J))-600
      TEPRI(ROL1(J))=0
 53   CONTINUE
      QUE6=QUE6+QUE5
      GO TO 56
 54   DO 55 J=1,K
      TEMP1=TEPRI(ROL1(J))-600
      IF(TEMP1.LT.0) GO TO 59
      IF(TEMP1.GT.100) GO TO 557
      CORBE(ENTE(J))=TEPRI(ROL1(J))-500
```

```
      TEPRI(ROL1(J))=0
      GO TO 55
 59   CORBE(ENTE(J))=TEPRI(ROL1(J))-400
      TEPRI(ROL1(J))=0
      GO TO 55
 557  CORBE(ENTE(J))=TEPRI(ROL1(J))-600
      TEPRI(ROL1(J))=0
 55   CONTINUE
      TP=TP-K
      A5(CY-CYCLE+1)=K
      QUE6=QUE6+K
 56   O=1
      DO 516 I=1,200
      IF(TEPRI(I).GT.0) GO TO 516
      ENTF(O)=I
      O=O+1
 516  CONTINUE
C
C     FORM THE PROMOTION LIST OF THE LIEUTENANT J.G.
C
C     FORMAR EL CUADRO DE ASCENSO DE TENIENTES SEGUNDOS
C
      KK=1
      LL=1
      MM=1
C
C     IN VEC1 ARE ALL THE ONES WHO HAVE 3 YEARS IN THE GRADE
C
C     EN VEC1 ESTAN LOS QUE TIENEN 3 ANOS EN EL GRADO
C
      TS=0
      K1=1
      K2=1
      K3=1
      DO 60 I=1,200
      IF(TESE(I).LT.300) GO TO 61
      IF(TESE(I).GT.335) GO TO 61
      VEC1(K1)=I
      K1=K1+1
      GO TO 660
C
C     IN VEC2 ARE ALL THE ONES WHO HAVE 4 YEARS IN THE GRADE
C
C     EN VEC2 ESTAN LOS QUE TIENEN 4 ANOS EN EL GRADO
C
 61   IF(TESE(I).LT.400) GO TO 62
      IF(TESE(I).GT.435) GO TO 62
      VEC2(K2)=I
      K2=K2+1
      GO TO 660
C
C     IN VEC3 ARE ALL THE ONES WHO HAVE 5 YEARS IN THE GRADE
C
C     EN VEC3 ESTAN LOS QUE TIENEN 5 ANOS EN EL GRADO
C
 62   IF(TESE(I).LT.500) GO TO 660
      IF(TESE(I).GT.535) GO TO 660
      VEC3(K3)=I
      K3=K3+1
C
C     ADVANCE ONE YEAR THE LIEUTENANT JUNIOR GRADES
C
 660  IF(TESE(I).GT.0) TESE(I)=TESE(I)+101
      IF(TESE (I).GT.0) TS=TS+1
 60   CONTINUE
      K=K1+K2+K3-3
      IF(REKIS(6).GT.QUE6) QUE6=REKIS(6)
C
C     FORM THE PROMOTION LIST AND PROMOTE
C     THE NECESSARY NUMBER OF PEOPLE
C
```

```
C     SE FORMA EL CUADRO DE ASCENSO Y SE ASCIENDE
C     AL NUMERO NECESARIO DE GENTE
C
      RE=REKIS(6)-TP
      QUE6=RE
      CALL SEROL(K)
      IF(K.LT.QUE6) GO TO 64
      TS=TS-QUE6
      A6(CY-CYCLE+1)=QUE6
      DO 63 J=1,QUE6
      TEMP1=TESE(ROL1(J))-500
      IF(TEMP1.LT.0) GO TO 68
      IF(TEMP1.GT.100) GO TO 67
      TEPRI(ENTF(J))=TESE(ROL1(J))-400
      TESE (ROL1(J))=0
      GO TO 63
 68   TEPRI(ENTF(J))=TESE(ROL1(J))-300
      TESE (ROL1(J))=0
      GO TO 63
 67   TEPRI(ENTF(J))=TESE(ROL1(J))-500
      TESE (ROL1(J))=0
 63   CONTINUE
      QUE7=QUE7+QUE6
      GO TO 66
 64   DO 65 J=1,K
      TEMP1=TESE(ROL1(J))-500
      IF(TEMP1.LT.0) GO TO 69
      IF(TEMP1.GT.100) GO TO 667
      TEPRI(ENTF(J))=TESE(ROL1(J))-400
      TESE (ROL1(J))=0
      GO TO 65
 69   TEPRI(ENTF(J))=TESE(ROL1(J))-300
      TESE (ROL1(J))=0
      GO TO 65
 667  TEPRI(ENTF(J))=TESE(ROL1(J))-500
      TESE (ROL1(J))=0
 65   CONTINUE
      TS=TS-K
      A6(CY-CYCLE+1)=K
      QUE7=QUE7+K
 66   O=1
      DO 616 I=1,200
      IF(TESE(I).GT.0) GO TO 616
      ENTG(O)=I
      O=O+1
 616  CONTINUE


C
C
C     FORM THE PROMOTION LIST OF THE ENSIGNS
C
C     FORMAR EL CUADRO DE ASCENSO DE ALFERECES DE FRAGATA
C
C
      KK=1
      LL=1
      MM=1
C
C     IN VEC1 ARE ALL THE CNES WHO HAVE 3 YEARS IN THE GRADE
C
C     EN VEC1 ESTAN LOS QUE TIENEN 3 ANOS EN EL GRADO
C
      AF=0
      K1=1
      K2=1
      K3=1
      DO 70 I=1,200
      IF(AFRA(I).LT.300) GO TO 71
      IF(AFRA(I).GT.335) GO TO 71
      VEC1(K1)=I
      K1=K1+1
```

```
      GO TO 770
C
C     IN VEC2 ARE ALL THE ONES WHO HAVE 4 YEARS IN THE GRADE
C
C     EN VEC2 ESTAN LOS QUE TIENEN 4 ANOS EN EL GRADO
C
 71   IF(AFRA(I).LT.400) GO TO 72
      IF(AFRA(I).GT.435) GO TO 72
      VEC2(K2)=I
      K2=K2+1
      GO TO 770
C
C     IN VEC3 ARE ALL THE ONES WHO HAVE 5 YEARS IN THE GRADE
C
C     EN VEC3 ESTAN LOS QUE TIENEN 5 ANOS EN EL GRADO
C
 72   IF(AFRA(I).LT.500) GO TO 770
      IF(AFRA(I).GT.535) GO TO 770
      VEC3(K3)=I
      K3=K3+1
C
C     ADVANCE ONE YEAR THE ENSIGNS
C
 770  IF(AFRA(I).GT.0) AFRA(I)=AFRA(I)+101
      IF(AFRA (I).GT.0) AF=AF+1
 70   CONTINUE
      K=K1+K2+K3-3
      IF(REKIS(7).GT.QUE7) QUE7=REKIS(7)
C
C     FORM THE PROMOTION LIST AND PROMOTE
C     THE NECESSARY NUMBER OF PEOPLE
C
C     SE FORMA EL CUADRO DE ASCENSO Y SE ASCIENDE
C     AL NUMERO NECESARIO DE GENTE
C
C
      RE=REKIS(7)-TS
      QUE7=RE
      CALL SPROL(K)
      IF(K.LT.QUE7) GO TO 74
      AF=AF-QUE7
      A7(CY-CYCLE+1)=QUE7
      DO 73 J=1,QUE7
      TEMP1=AFRA(ROL1(J))-500
      IF(TEMP1.LT.0) GO TO 78
      IF(TEMP1.GT.100) GO TO 77
      TESE(ENTG(J))=AFRA(ROL1(J))-400
      AFRA (ROL1(J))=0
      GO TO 73
 78   TESE(ENTG(J))=AFRA(ROL1(J))-300
      AFRA (ROL1(J))=0
      GO TO 73
 77   TESE(ENTG(J))=AFRA(ROL1(J))-500
      AFRA (ROL1(J))=0
 73   CONTINUE
      QUE8=QUE8+QUE7
      GO TO 76
 74   DO 75 J=1,K
      TEMP1=AFRA(ROL1(J))-500
      IF(TEMP1.LT.0) GO TO 80
      IF(TEMP1.GT.100) GO TO 777
      TESE(ENTG(J))=AFRA(ROL1(J))-400
      AFRA (ROL1(J))=0
      GO TO 75
 80   TESE(ENTG(J))=AFRA(ROL1(J))-300
      AFRA (ROL1(J))=0
      GO TO 75
 777  TESE(ENTG(J))=AFRA(ROL1(J))-500
      AFRA (ROL1(J))=0
 75   CONTINUE
      AF=AF-K
      A7(CY-CYCLE+1)=K
```

```
      QUE8=QUE8+K
      IF(REKIS(8).GT.QUE8) QUE8=REKIS(8)
76    O=1
      DO 716 I=1,200
      IF(AFRA(I).GT.0) GO TO 716
      ENTH(O)=I
      O=O+1
716   CONTINUE
      KKK=CADET(5)
      DO 79 I=1,KKK
      IF(ENTH(I).GT.200) GO TO 79
      AFRA(ENTH(I))=101
79    CONTINUE
      CADET(5)=CADET(4)
      CADET(4)=CADET(3)
      CADET(3)=CADET(2)
      CADET(2)=CADET(1)
      CADET(1)=INGO
      WRITE(6,203)
203   FORMAT('0',' SLGO DE AVANCE')
      RETURN
      END
C
C
C
C
C
C
C
C


      SUBROUTINE PROL(K)
C
C
C    THIS SUBROUTINE DETERMINES THE DISTRIBUTION
C    IN THE PROMOTION LIST OF REAR ADMIRALS
C
C
C    DETERMINA LA DISTRIBUCION EN EL CUADRO DE
C    ASCENSO DE CALM.
C
C
      IMPLICIT INTEGER(A-Y)
      COMMON/NADA/ AFRA(200), TESE(200), TEPRI(200),
     1CORBE(150), CAFRA(100),CANAV(80), CALM(50), VALM(10),
     2ENTA(10),ENTB(50),ENTC(80),ENTD(100),ENTE(150),
     3ENTF(200),ENTG(200),ENTH(200),QUE1,QUE2,QUE3,
     4QUE4,QUE5,QUE6,QUE7,QUE8,VEC1(200),VEC2(200),
     5VEC3(200),ROL1(600),IX,K1,K3,K2,KK,LL,MM,INGO,
     6CADET(5),REKIS(8),CY,Z1(100),A1(50),A2(50),A3(50),
     7A4(50),A5(50),A6(50),A7(50),CYCLE
      DIMENSION BALL(10)
      DATA BALL/2*1,4*2,4*3/
      A=10
      IF(K.LT.10) A=K
      DO 10 I=1,A
      CALL ROLNO(I,BALL)
10    CONTINUE
      BALL(1)=1
      BALL(2)=1
      BALL(3)=1
      BALL(4)=2
      BALL(5)=2
      BALL(6)=2
      BALL(7)=3
      BALL(8)=3
      BALL(9)=3
      BALL(10)=3
      IF(K.LT.10) GO TO 12
      DO 11 I=10,K
      CALL ROLNO(I,BALL)
```

```
 11     CONTINUE
 12     KK=1
        LL=1
        MM=1
        RETURN
        END
C
C
C
C
C
C


        SUBROUTINE SROL(K)
C
C
C     THIS SUBROUTINE DETERMINES THE DISTRIBUTION
C     IN THE PROMOTION LIST OF CAPTAINS
C
C
C     DETERMINA LA DISTRIBUCION EN EL CUADRO DE
C     ASCENSO DE CANAV.
C
C
        IMPLICIT INTEGER(A-Y)
        COMMON/NADA/ AFRA(200), TESE(200), TEPRI(200),
       1CORBE(150), CAFRA(100),CANAV(80), CALM(50), VALM(10),
       2ENTA(10),ENTB(50),ENTC(80),ENTD(100),ENTE(150),
       3ENTF(200),ENTG(200),ENTH(200),QUE1,QUE2,QUE3,
       4QUE4,QUE5,QUE6,QUE7,QUE8,VEC1(200),VEC2(200),
       5VEC3(200),ROL1(600),IX,K1,K3,K2,KK,LL,MM,INGO,
       6CADET(5),REKIS(8),CY,Z1(100),A1(50),A2(50),A3(50),
       7A4(50),A5(50),A6(50),A7(50),CYCLE
        DIMENSION BALL(10)
        DATA BALL/2*1,4*2,4*3/
        A=10
        IF(K.LT.10) A=K
        DO 10 I=1,A
        CALL ROLNO(I,BALL)
 10     CONTINUE
        BALL(1)=1
        BALL(2)=1
        BALL(3)=1
        BALL(4)=2
        BALL(5)=2
        BALL(6)=2
        BALL(7)=3
        BALL(8)=3
        BALL(9)=3
        BALL(10)=3
        IF(K.LT.10) GO TO 12
        DO 11 I=10,K
        CALL ROLNO(I,BALL)
 11     CONTINUE
 12     KK=1
        LL=1
        MM=1
        RETURN
        END
C
C
C
C
C
C
C
```

```
      SUBROUTINE TROL(K)
C
C
C     THIS SUBROUTINE DETERMINES THE DISTRIBUTION
C     IN THE PRCMOTION LIST OF COMMANDERS
C
C
C     DETERMINA LA DISTRIBUCION EN EL CUADRO DE
C     ASCENSO DE CAFRA.
C
C
      IMPLICIT INTEGER(A-Y)
      COMMON/NADA/ AFRA(200), TESE(200), TEPRI(200),
     1CORBE(150), CAFRA(100),CANAV(80), CALM(50), VALM(10),
     2ENTA(10),ENTB(50),ENTC(80),ENTD(100),ENTE(150),
     3ENTF(200),ENTG(200),ENTH(200),QUE1,QUE2,QUE3,
     4QUE4,QUE5,QUE6,QUE7,QUE8,VEC1(200),VEC2(200),
     5VEC3(200),ROL1(600),IX,K1,K3,K2,KK,LL,MM,INGO,
     6CADET(5),REKIS(8),CY,Z1(100),A1(50),A2(50),A3(50),
     7A4(50),A5(50),A6(50),A7(50),CYCLE
      DIMENSION BALL(10)
      DATA BALL/2*1,4*2,4*3/
      A=10
      IF(K.LT.10) A=K
      DO 10 I=1,A
      CALL ROLNO(I,BALL)
 10   CONTINUE
      BALL(1)=1
      BALL(2)=1
      BALL(3)=1
      BALL(4)=2
      BALL(5)=2
      BALL(6)=2
      BALL(7)=3
      BALL(8)=3
      BALL(9)=3
      BALL(10)=3
      IF(K.LT.10) GO TO 12
      DO 11 I=10,K
      CALL ROLNO(I,BALL)
 11   CONTINUE
 12   KK=1
      LL=1
      MM=1
      RETURN
      END
C
C
C
C
C
C


      SUBROUTINE CROL(K)
C
C
C     THIS SUBROUTINE DETERMINES THE DISTRIBUTION
C     IN THE PROMOTION LIST OF LIEUTENANT COMMANDERS
C
C
C     DETERMINA LA DISTRIBUCION EN EL CUADRO DE
C     ASCENSO DE CORBE.
C
C
      IMPLICIT INTEGER(A-Y)
      COMMON/NADA/ AFRA(200), TESE(200), TEPRI(200),
     1CORBE(150), CAFRA(100),CANAV(80), CALM(50), VALM(10),
```

```
     2ENTA(10),ENTB(50),ENTC(80),ENTD(100),ENTE(150),
     3ENTF(200),ENTG(200),ENTH(200),QUE1,QUE2,QUE3,
     4QUE4,QUE5,QUE6,QUE7,QUE8,VEC1(200),VEC2(200),
     5VEC3(200),ROL1(600),IX,K1,K3,K2,KK,LL,MM,INGO,
     6CADET(5),REKIS(8),CY,Z1(100),A1(50),A2(50),A3(50),
     7A4(50),A5(50),A6(50),A7(50),CYCLE
      DIMENSION BALL(10)
      DATA BALL/4*1,3*2,3*3/
      DO 10 I=1,K
      CALL ROLNO(I,BALL)
 10   CONTINUE
      KK=1
      LL=1
      MM=1
      RETURN
      END
C
C
C
C
C
C


      SUBROUTINE QROL(K)
C
C
C    THIS SUBROUTINE DETERMINES THE DISTRIBUTION
C    IN THE PROMOTION LIST OF LIEUTENANTS
C
C
C    DETERMINA LA DISTRIBUCION EN EL CUADRO DE
C    ASCENSO DE TEPRI.
C
C
      IMPLICIT INTEGER(A-Y)
      COMMON/NADA/ AFRA(200), TESE(200), TEPRI(200),
     1CORBE(150), CAFRA(100),CANAV(80), CALM(50), VALM(10),
     2ENTA(10),ENTB(50),ENTC(80),ENTD(100),ENTE(150),
     3ENTF(200),ENTG(200),ENTH(200),QUE1,QUE2,QUE3,
     4QUE4,QUE5,QUE6,QUE7,QUE8,VEC1(200),VEC2(200),
     5VEC3(200),ROL1(600),IX,K1,K3,K2,KK,LL,MM,INGO,
     6CADET(5),REKIS(8),CY,Z1(100),A1(50),A2(50),A3(50),
     7A4(50),A5(50),A6(50),A7(50),CYCLE
      DIMENSION BALL(10)
      DATA BALL/4*1,3*2,3*3/
      DO 10 I=1,K
      CALL ROLNO(I,BALL)
 10   CONTINUE
      KK=1
      LL=1
      MM=1
      RETURN
      END
C
C
C
C
C
C
C


      SUBROUTINE SEROL(K)
C
C
C    THIS SUBROUTINE DETERMINES THE DISTRIBUTION
C    IN THE PROMOTION LIST OF LIEUTENANTSJ.G.
C
C
C    DETERMINA LA DISTRIBUCION EN EL CUADRO DE
C    ASCENSO DE TESE.
```

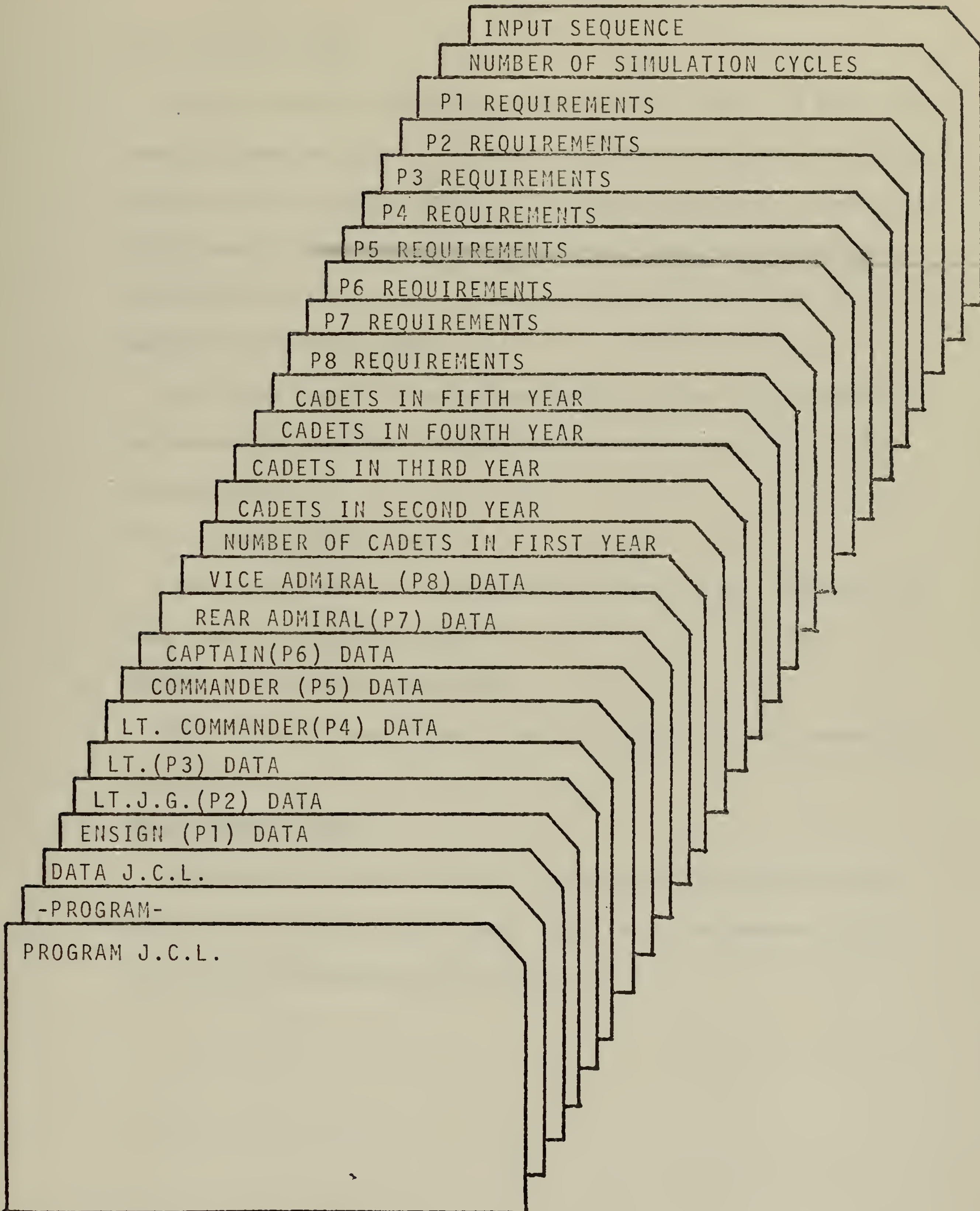
```
C
C
      IMPLICIT INTEGER(A-Y)
      COMMON/NADA/ AFRA(200), TESE(200), TEPRI(200),
     1CORBE(150), CAFRA(100),CANAV(80), CALM(50), VALM(10),
     2ENTA(10),ENTB(50),ENTC(80),ENTD(100),ENTE(150),
     3ENTF(200),ENTG(200),ENTH(200),QUE1,QUE2,QUE3,
     4QUE4,QUE5,QUE6,QUE7,QUE8,VEC1(200),VEC2(200),
     5VEC3(200),ROL1(600),IX,K1,K3,K2,KK,LL,MM,INGO,
     6CADET(5),REKIS(8),CY,Z1(100),A1(50),A2(50),A3(50),
     7A4(50),A5(50), A6(50),A7(50),CYCLE
      DIMENSION BALL(10)
      DATA BALL/4*1,3*2,3*3/
      DO 10 I=1,K
      CALL ROLNO(I,BALL)
 10   CONTINUE
      KK=1
      LL=1
      MM=1
      RETURN
      END
C
C
C
C
C
      SUBROUTINE SPROL(K)
C
C
C     THIS SUBROUTINE DETERMINES THE DISTRIBUTION
C     IN THE PROMOTION LIST OF ENSIGNS
C
C
C     DETERMINA LA DISTRIBUCION EN EL CUADRO DE
C     ASCENSO DE AFRA.
C
C
      IMPLICIT INTEGER(A-Y)
      COMMON/NADA/ AFRA(200), TESE(200), TEPRI(200),
     1CORBE(150), CAFRA(100),CANAV(80), CALM(50), VALM(10),
     2ENTA(10),ENTB(50),ENTC(80),ENTD(100),ENTE(150),
     3ENTF(200),ENTG(200),ENTH(200),QUE1,QUE2,QUE3,
     4QUE4,QUE5,QUE6,QUE7,QUE8,VEC1(200),VEC2(200),
     5VEC3(200),ROL1(600),IX,K1,K3,K2,KK,LL,MM,INGO,
     6CADET(5),REKIS(8),CY,Z1(100),A1(50),A2(50),A3(50),
     7A4(50),A5(50),A6(50),A7(50),CYCLE
      DIMENSION BALL(10)
      DATA BALL/4*1,3*2,3*3/
      DO 10 I=1,K
      CALL ROLNO(I,BALL)
 10   CONTINUE
      KK=1
      LL=1
      MM=1
      RETURN
      END
C
C
C
C
C
C
C
C
C
C
C
C
C
```

```
      SUBROUTINE ROLNO(I,BALL)
C
C
C
C
C     ESTA SUBRUTINA DETERMINA EL PUESTO EN EL
C     CUADRO DE ASCENSO DE CUALQUIER GRADO
C
C     THIS SUBROUTINE DETERMINES THE PLACE IN
C     THE PROMOTION LIST IN ANY GRADE
C
C
C
      IMPLICIT INTEGER(A-Y)


      COMMON/NADA/ AFRA(200), TESE(200), TEPRI(200),
     1CORBE(150), CAFRA(100),CANAV(80), CALM(50), VALM(10),
     2ENTA(10),ENTB(50),ENTC(80),ENTD(100),ENTE(150),
     3ENTF(200),ENTG(200),ENTH(200),QUE1,QUE2,QUE3,
     4QUE4,QUE5,QUE6,QUE7,QUE8,VEC1(200),VEC2(200),
     5VEC3(200),ROL1(600),IX,K1,K3,K2,KK,LL,MM,INGO,
     6CADET(5),REKIS(8),CY,Z1(100),A1(50),A2(50),A3(50),
     7A4(50),A5(50),A6(50),A7(50),CYCLE
      DIMENSION BALL(10)
      IX=IX*65539
      Z=0.5+IX*0.2328306E-9
      J=10*Z+1
      TJ=BALL(J)
      K4=K1+K2+K3
      KKK=KK+LL+MM
      IF(KKK.EQ.K4) GO TO 20
      GO TO (11,12,13),TJ
   11 IF(KK.GE.K1) GO TO 12
      ROL1(I)=VEC1(KK)
      KK=KK+1
      GO TO 20
   12 IF(LL.GE.K2) GO TO 13
      ROL1(I)=VEC2(LL)
      LL=LL+1
      GO TO 20
   13 IF(MM.GE.K3) GO TO 11
      ROL1(I)=VEC3(MM)
      MM=MM+1
   20 RETURN
      END
C
C
C
C
C
C
C


      BLOCK DATA
C
C
      IMPLICIT INTEGER(A-Y)
      COMMON/NADA/ AFRA(200), TESE(200), TEPRI(200),
     1CORBE(150), CAFRA(100),CANAV(80), CALM(50), VALM(10),
     2ENTA(10),ENTB(50),ENTC(80),ENTD(100),ENTE(150),
     3ENTF(200),ENTG(200),ENTH(200),QUE1,QUE2,QUE3,
     4QUE4,QUE5,QUE6,QUE7,QUE8,VEC1(200),VEC2(200),
     5VEC3(200),ROL1(600),IX,K1,K3,K2,KK,LL,MM,INGO,
     6CADET(5),REKIS(8),CY,Z1(100),A1(50),A2(50),A3(50),
     7A4(50),A5(50),A6(50),A7(50),CYCLE
      DATA QUE1,QUE2,QUE3,QUE4,QUE5,QUE6,QUE7,QUE8/0,0,0,0,0
      DATA IX,KK,LL,MM/5,1,1,1/
      END
```

APPENDIX D CARD ASSEMBLY



DATA INPUT

A. P1 to P8 DATA CARDS

There is one card for each officer in the system. A four-digit number is punched in col. 1-4 with the first two digits identifying years in the particular grade and the second two digits signifying total years in the system. The digit pairs are right adjusted if less than 10.

B. CADETS IN EACH YEAR CARDS

The total number of cadets goes in col. 1-4. If the number to be punched is less than four digits, it can go in any of the four columns mentioned.

C. P8 to P1 REQUIREMENTS CARDS

The total number of officer required goes in col. 1-4 with the same generality as cards in B.

D. NUMBER OF SIMULATION CYCLES CARD

The number of years goes in col. 1-4, with the same generality as cards in B.

E. INPUT SEQUENCE CARDS

There has to be one card for each year with the total number of new cadet inputs on each card. This has to be punched in col. 1-4, with the same generality as cards in B.

OUTPUTS

The output is produced in four forms. To produce any of the different outputs one has to call it with the number:

1. To produce an output listing of all the contents of the data base.

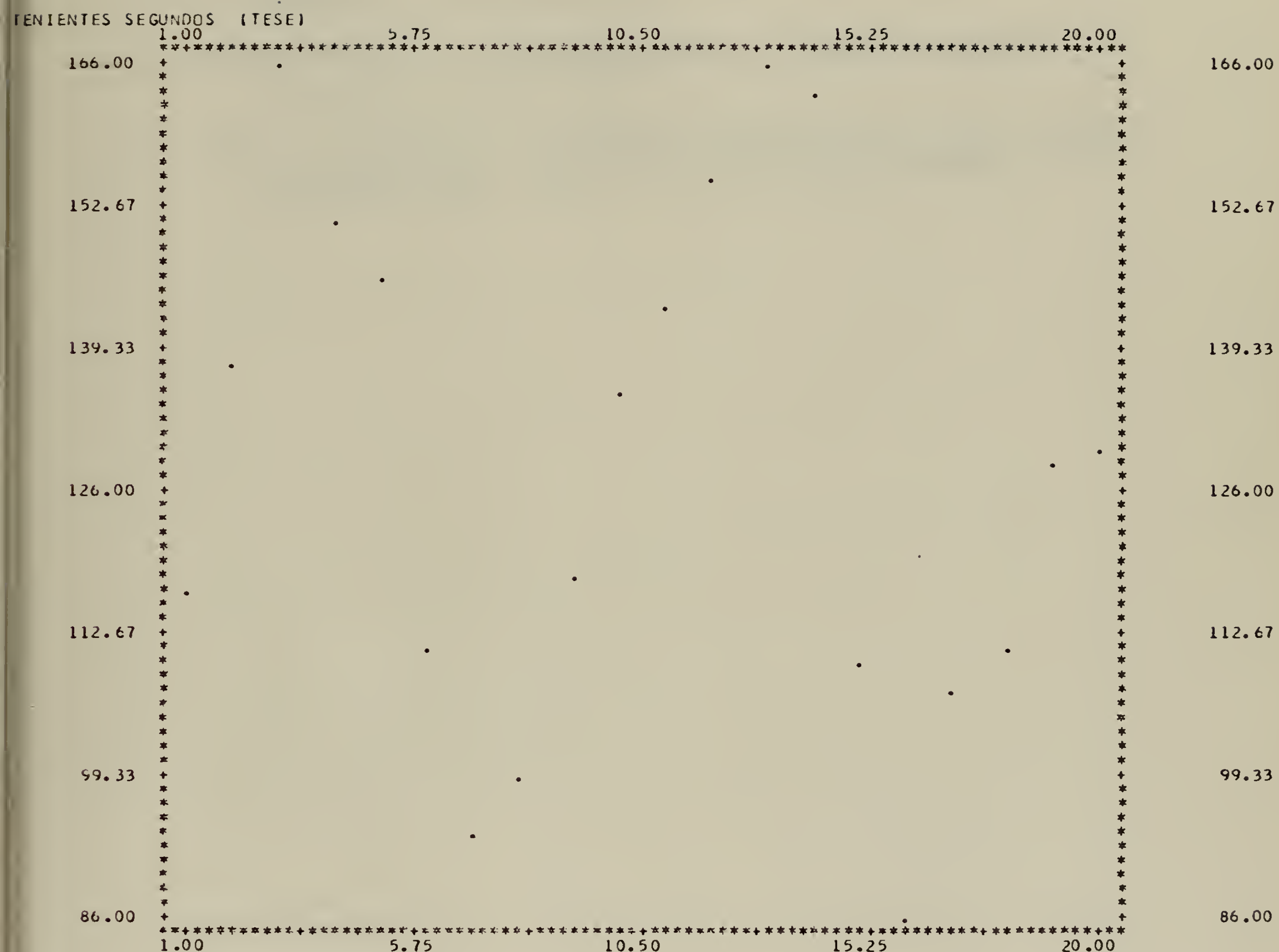
3. To produce a plotting for each grade of the quantity of people in the Y axis and the year of simulation in the X axis. This call has to be at the end of the simulation but in order to fill the necessary vectors of information one has to call this subroutine with the number 2 each cycle of the simulation.

4. To produce a table showing the number of people promoted from one grade to the next each year of simulation.

5. To produce a listing of the values of requirements in each grade each year, the value of the input to the system each year, the cycle number, and the number of cadets in each year of the academy, each year.

An example of output produced with the number 3 is presented in the next page.

SAMPLE OUTPUT



X-SCALE: "*"= 0.237E 00 UNITS

Y-SCALE: "*"= 0.133E 01 UNITS

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Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

ORIGINATING ACTIVITY (Corporate author) Naval Postgraduate School Monterey, California 93940	2a. REPORT SECURITY CLASSIFICATION Unclassified
	2b. GROUP

REPORT TITLE

Personnel System Projection Model

DESCRIPTIVE NOTES (Type of report and, inclusive dates)
Master's Thesis; December 1972

AUTHOR(S) (First name, middle initial, last name)

Luis Vargas Cooban

REPORT DATE December 1972	7a. TOTAL NO. OF PAGES 74	7b. NO. OF REFS 4
CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)	
PROJECT NO.		
	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	

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ABSTRACT

A personnel system is simulated so that the personnel planner can use this simulation as a tool to help solve manpower problems utilizing the benefits of a computer. The input parameters are time in grade and time in the system of each individual, the manpower requirements in each grade, annual input to the system, and the number of years to run the simulation. The dynamic properties of the simulation are loss rates and promotion rates. A decision maker runs the model to determine the effects of changes in the input parameters. One of the problems that can be solved with the model is manpower shortage. A sample problem is presented. Flowcharts and a listing of the FORTRAN program are included.

KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Manpower						
Simulation						
Personnel						
Projection Model						
Personnel Planner Aide						
Personnel Planning						
Computer Simulation						